

GYNECOLOGY

BY

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AND

COLLABORATORS

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TO ALL MEMBERS OF THE PROFESSION WHO TAKE
THE TORCH
TO BEAR IT ONWARD TO THAT PERFECT DAY
WHEN SUFFERING AND SORROW WILL HAVE FLED

ἄλλοι κεκοπιάκασιν καὶ ὑμεῖς εἰς τὸν κόπον αὐτῶν εἰσεληλύθατε

PREFACE

The day's work done, in the chiaroscuro of the evening I pen my last lines, recording the *quis, quid, quibus auxiliis, quomodo*, in other words, the rationale of sundry innovations in my work, and ruminating, as I write, upon the happy associations and renewals of friendships and instruction I have received as the work has advanced to its completion.

Among the first, I would mention Elwyn Clarke who beguiled me into my task and then stood by as a faithful friend while I struggled, enmeshed in the toils of those sundry and always unforeseeable difficulties which foregather out of the thin air to clutter the path of the would-be author.

I think next of my colleague, Curtis F. Burnam, and his constant kindly encouragement and substantial aid as the first year dwindled and then an added year of work loomed upon the horizon.

Thomas S. Cullen, ever valued coadjutor, has contributed by putting the hearty coöperation of his present and quondam staff—Lawrence R. Wharton, Richard W. Telinda, Leo Brady, George H. Gardner, R. Glenn Craig, Herbert Traut, Robert Faulkner—at my disposal, and what yeoman services they have rendered.

I am indebted, too, to G. H. Gardner, R. G. Craig, and R. Faulkner for their selection of slides for photomicrographs made by H. F. Traut and H. A. McCordock.

Guy L. Hunner, old associate of earlier days and constant counsellor, has also lent sympathy and substantial aid.

Max Broedel, who left the Fatherland for this country many years ago, in response to my Macedonian call, to interpret medicine in art as never before and to found a new school, setting a pace and establishing precedents for the world, has helped to the limit of his ability in the midst of his crowded offices. Nor can I omit in this connection to mention our faithful August Horn, great artist, who laid down his life in a work which survives him, nor Hermann Becker, still fruitful in the field of art in medicine.

John Sampson, once collaborer on our staff in the Hopkins has advised generously but cautiously regarding the presentation of his own original work.

In these days of universal evaluation, alas, I cannot evaluate the gracious compliance to my S. O. S. of George Gray Ward and Lillian K. P. Farrar, nor that of Reuben Peterson, Isidor Rubin, George Gellhorn, Robert M. Lewis, W. W. Scott, Robert W. Johnson, Cecil Vest, Emil Novak, Wm. E. Lower, and Esther Richards.

Among my immediate daily associates, I would mention with appreciation William Neill, Grant E. Ward, Robert E. Fricke, and Fred West.

And last in a firstly sense, I acknowledge the unstinted services and critical judgment of my coworker, Audrey W. Davis—services too large to be written down.

Not often does one man have a chance to write two books on the same subject at an interval of a generation, especially after such notable changes as the gynecological field has witnessed.

In my professional nonage, in the late eighties, it is interesting to recall how completely worked out our specialty seemed to be. T. A. Emmet naively tells us in his reminiscences that he tried in vain to establish his son, Duncan, in his place, because Duncan would be sure to perpetuate his father's methods. But the torch of M. Sims, T. A. Emmet, R. Peaslee, S. G. Thomas, N. Bozeman, and J. B. Hunter of New York, and of Uncle John Homans of Boston, and of W. Atlee, J. S. Parry, and Wm. Goodell of Philadelphia, and of W. H. Byford of Chicago, and of P. Mundé, who stood midway between the old and the new, and A. J. Skene of Brooklyn, was handed down to a vigorous group of youngsters—W. M. Polk, Harry Coe, Gill Wylie, Wm. R. Pryor, George M. Edebohls, F. Krug, Hermann Boldt, and Palmer Dudley of New York, and to R. L. Dickinson and J. O. Polak of Brooklyn, and to W. H. Baker, E. Reynolds, and Walter L. Burrage of Boston, and to Benny Baer, the Prices, Joe and Mort, Mont. Baldy, C. B. Penrose, C. P. Noble, and B. C. Hirst of Philadelphia, and to Matthew D. Mann of Buffalo, and to the redoubtable E. C. Dudley, the lusty young H. T. Byford, and Franklin Martin of Chicago, and to Taber Johnson of Washington following S. C. Busey, and to J. Ross of Toronto, and to W. Gardner and J. J. Alloway of Montreal, not to enumerate a host of other worthies who took their places in the gynecological literature of the new era.

Those twenty-five years, 1880-1905, were epoch-making, as the new leaven worked in the old lump to produce an emergent new loaf.

Given a fair possibility of success in ovariectomy (E. McDowell) and even in hysteromyomectomy (G. Kimball, W. Burnham, and W. Atlee), and given anesthesia and the dawning basic knowledge of pathology, and crown these acquisitions with asepsis, and who could predict the results of the confluence of these scaturient sources?

And so, after a respiratory breathing spell, discoveries began like homing pigeons to fly to the roost of the gynecological columbarium.

Surveying our field in retrospect, it did not rain but it poured on a fertile soil. Beginning by questioning and then decisively discarding many of our inherited nosological concepts, we soon tossed to the winds erosions and ulcers of the cervix, uterine flexions, endometritis, metritis, cellulitis, parametritis, cervical stenosis, irritable uterus, hematocoele, as in any sense dominant. Also in treatment, pessaries went into the discard by the thousands, and the polypharmacy of our predecessors departed with their useless paintings and packings of the vaginal vault, the discussions of the cervix, and the dangerous sponge tents.

Pari passu with this iconoclasm, pelvic pathology, basic in our scientific work, gained a foothold and the fruitful autopsy at last prevailed.

We possess to-day a routine laboratory technique which was only in its infancy in the late eighties. Blood examinations are more uniform; urea, nonprotein nitrogen, and basal metabolism are more constantly estimated; glycemia, the precursor of diabetes, is a daily inquest, especially illuminating in pruritus; diabetics are operated upon with a large margin of safety; calcium bids fair shortly to come into its own in menstrual aberrations.

Gonorrhea (E. Noegerrath) in its various clinical forms has an established status, and syphilis (A. von Wassermann) is recognized in thousands weekly, whereas formerly it was but a tentative, often labelled brilliant, diagnosis too frequently worked out by the potassium iodid toleration test.

Sterility (I. Rubin) is studied with a new zest with the easily available insufflation test.

The orthopedist (J. Goldthwait) has conferred an inestimable boon in locating a common cause of backache in movable sacro-iliac joints.

The whole range of vesical, ureteral, and kidney diseases has taken on a new aspect under the revelatory methods of examination, especially the knee-chest posture, the open air cystoscope, and the ureteral catheter. The classical vesico-vaginal fistula (A. K. Mackenrodt) is treated with far greater certainty and effectiveness than by our predecessors on an entirely new principle.

Endometrioma (J. Sampson) bids fair to assume an unparalleled significance.

Cancer is more readily recognized and is often graded in its degree of malignancy (A. C. Broders) and is attributed to unhealed cervical lacerations.

The large field of prolapses and their congeners has taken on an entirely new aspect, developing in conformity with the sound principles of a new anatomy of the pelvic fascias and ligaments (B. E. Hadra, E. Reynolds, J. R. Goffe, R. T. Frank, A. B. Spalding, George Gray Ward).

The dystrophia adiposogenitalis is recognized as a well-defined clinical entity.

Endocrinology and organotherapy are new if as yet somewhat disappointing concepts.

Psychoneuroses claim their recognition in the gynecological routine, often requiring the coöperation of a neurologist in determining their gravity and in regulating the treatment.

Protein therapy makes large claims under investigation.

The x-ray has appeared as one of the greatest boons within a generation as a diagnostic instrument, especially in urinary diseases, and as a therapeutic agent in many specialists' hands.

Radium, an astonishing and most unpredictable therapeutic agent, is one of the newer boons of the age, obviating many surgical operations.

Endothermy has come in no small measure to replace the scalpel and to coöperate with our routine surgical measures often rendering them far more effective (Wm. Clark, George A. Wyeth).

There also appears on our horizon to-day another potent influence for good, carefully cultivated in at least one large hospital; namely, a system of thorough follow-up work, evaluating results.

Multiple operations at one sitting, formerly rarely thought of, are common events combining vaginal plastic and abdominal pelvic operations and extirpation of an appendix or gall-bladder.

Gynecology which once threw off the trammels of obstetrics is now coyly courting her own mother and here and there returning to her ancestral home under the guidance of rare men of acumen and skill in both specialties, an amalgamation still nascent.

There is yet room for a sympathetic review of the relations of gynecologist and dermatologist, to the advantage of the former.

There is also a call for a thoroughgoing study of focal infections in relation to gynecology.

All these notable changes have come with corresponding improvements in medical education, in the obliteration of poorly equipped schools or in their amalgamation

with others, and in a longer course of study, followed by better-prepared men. Our standardized hospitals are incomparably better. There is a return by those who are eager to learn to the peripatetic habits of bygone centuries. All these beneficent impulses have originated in a small group of devoted earnest doctors, inspiring by their self-sacrifice and persistence the rank and file of a hundred thousand *Æsculapians* in these United States and Canada.

In my previous volumes, I was the first to write *esophagus* and *edema*, avoiding the ever awkward diphthong *æ*; this spelling has become current. I expunge so far as possible the *æ* diphthong for *e*, as in *hematoma* and *hematocele*, a great gain, I take it. I have not hesitated to reduce *pollakiuria* to the simpler euphony of *pollakuria*, also better than Roswell Park's "*thammuria*." I avoid incremental adjectives and adverbs, especially the tiresome useless "*very*." Since such words as *appendix*, *cervix*, *tubes*, and *adnexa* have come to stay, I have adopted them instead of the more explicative *appendix vermiformis*, *cervix uteri*, *uterine* or *fallopian tubes*, while *appendectomy*, atrocious derivatively, is far more acceptable to the tongue, understandable, and incomparably superior to the correct *ecphyadectomy*, but I have not yet "gotten the consent of my own mind" to say or write *appendiceal*.

Familiar nuisances in gynecological literature are the ever recurring "*case*" and "*patient*"; I hope I have not overworked my ingenuity hunting for substitutes.

It seems well in legends and case reports, as nearly as possible, to present the bare bones *asyndetically*, connectives expunged.

"*Cure*" is a phobia to many, but I do not hesitate to use the word in the interest of the patient, without, however, failing to note the vital need of watching over all our patients "*cured*" of malignancy.

The personal pronoun throughout refers to my own work.

My pleasant task is done; the shadows fall well aslant my page; it is almost time to draw the curtains and turn on the Great Light.

To boon companions and fellow-travelers all—Vale.

Baltimore, Maryland

HOWARD ATWOOD KELLY

CONTENTS

CHAPTER	PAGE
I. ANATOMY Howard A. Kelly	1
II. HISTOLOGY R. Glenn Craig	35
III. THE GYNECOLOGICAL EXAMINATION Howard A. Kelly	60
IV. SUNDRY DIAGNOSTIC AIDS Howard A. Kelly	93
V. DILATATION AND CURETTAGE Howard A. Kelly	98
VI. CONGENITAL MALFORMATIONS AND DEVELOPMENTAL DEFECTS Lawrence R. Wharton	107
VII. MENSTRUATION, AMENORRHEA, DYSMENORRHEA Emil Novak	116
VIII. UTERINE HEMORRHAGE Howard A. Kelly	140
IX. ENDOCRINOLOGY AND ORGANOOTHERAPY Emil Novak	152
X. STERILITY Lawrence R. Wharton	158
XI. PERUTERINE TUBAL INSUFFLATION IN STERILITY Isidor C. Rubin	169
XII. DISEASES OF THE VULVA Richard W. TeLinde	187
XIII. LEUKORRHEA Howard A. Kelly	222
XIV. PRURITUS Cecil W. Vest	227
XV. DYSPAREUNIA Howard A. Kelly	235
XVI. DISEASES OF THE CERVIX George H. Gardner	240

CHAPTER		PAGE
XVII.	LACERATIONS OF THE PERINEUM Howard A. Kelly	265
XVIII.	FASCIA AND LIGAMENTS OF THE PELVIC FLOOR Lilian K. P. Farrar	288
XIX.	CYSTOCELE AND PROLAPSUS UTERI George Gray Ward	305
XX.	RECTOCELE, ENTEROCELE, INJURY TO PELVIC FLOOR George Gray Ward	358
XXI.	TUMORS OF THE VAGINA Leo Brady	380
XXII.	GENERAL PRINCIPLES OF ABDOMINAL SURGERY Howard A. Kelly	389
XXIII.	SACRAL ANESTHESIA W. W. Scott	427
XXIV.	ABDOMINAL HYSTERECTOMY Howard A. Kelly	432
XXV.	VAGINAL HYSTERECTOMY Howard A. Kelly	444
XXVI.	BACKACHE Robert W. Johnson, Jr.	456
XXVII.	THE VERMIFORM APPENDIX IN GYNECOLOGY Richard W. TeLinde	470
XXVIII.	RETRODISPLACEMENT AND SUSPENSION OF UTERUS. SUSPENSION OF PROLAPSED OVARY Howard A. Kelly	480
XXIX.	TREATMENT OF UTERINE AND VAGINAL DISPLACEMENTS WITH PESSARIES Howard A. Kelly	488
XXX.	BENIGN TUMORS OF THE UTERUS Howard A. Kelly	496
XXXI.	MALIGNANT TUMORS OF THE UTERUS Howard A. Kelly	571
XXXII.	ADENOMYOMA Howard A. Kelly	618
XXXIII.	PELVIC ABSCESS Lawrence R. Wharton	624
XXXIV.	GONORRHEA Lawrence R. Wharton	634

CONTENTS

xiii

CHAPTER		PAGE
XXXV.	TUBERCULOUS SALPINGITIS Lawrence R. Wharton	660
XXXVI.	EXTRA-UTERINE PREGNANCY AND PREGNANCY IN A RUDIMENTARY UTERINE HORN Robert M. Lewis	673
XXXVII.	TUMORS OF THE OVARIES George H. Gardner and Herbert F. Traut	724
XXXVIII.	TUMORS OF THE FALLOPIAN TUBES Howard A. Kelly	789
XXXIX.	ENDOMETRIOMATA Robert M. Lewis	793
XL.	BLADDER AND URETHRA Howard A. Kelly	804
XLI.	URETERAL STRICTURE Guy L. Hunner	873
XLII.	TUMORS OF THE BLADDER Curtis F. Burnam and William Neill	900
XLIII.	PROTEIN THERAPY George Gellhorn	923
XLIV.	RADIUM Curtis F. Burnam	929
XLV.	X-RAY Robert E. Fricke	955
XLVI.	PNEUMOPERITONEAL ROENTGENOGRAPHY—A DIAGNOSTIC AID Reuben Peterson	965
XLVII.	ULTRAVIOLET RADIATION Robert E. Fricke	972
XLVIII.	ELECTROTHERMY Grant E. Ward	974
XLIX.	SOME TOPICS OF COMMON GROUND BETWEEN GYNECOLOGY AND PSYCHOPATHOLOGY (PSYCHIATRY AND MENTAL HYGIENE) Esther Loring Richards	995
INDEX	1013

ILLUSTRATIONS

FIGURE

PAGE

1. Infantile Pelvis, Sagittal Section	2
2. Pelvis of Adult Woman, Sagittal Section, Reduced to Conform to Infantile Pelvis for Comparison	2
3. Abdominal Muscles, Skin and Fat Reflected Showing External Oblique, Semilunar Line, and Fascia Covering Rectus on Left. On Right, External Oblique Reflected Upward Showing Internal Oblique. Pyramidalis Lies within Right Rectus Sheath Below	3
4. On Left Internal Oblique Reflected, Together with External Oblique and Sheath of Rectus, to Show Transversalis Muscle and Left Rectus. On Dividing Rectus in Middle, as on Right Side, Tendinous Posterior Sheath Is Seen Above, Ending at Semilunar Line below Umbilicus	4
5. Transverse Section above Semilunar Fold	5
6. Transverse Section below Semilunar Fold, Showing Absence of Posterior Fibrous Sheath behind Rectus as Well as Difference in Relation to the Muscles	6
7. Folds of Mesentery Showing Usual Orderly Arrangement in Groups Following Letters <i>A, B, C, D, E</i>	7
8. Various Groups of Small Intestine Corresponding to Letters in Figure 7	8
9. Normal Position of Ileocecal Apparatus	9
10. Positions of Moderate Displacements of Appendix, While Still in Right Lower Quadrant of Abdomen	9
11. The Pelvic Viscera	10
12. Uterus Pulled Out over Symphysis to Display Lateral Structures	11
13. Great Vascular Trunks of Lower Abdomen with Ovarian Vessels in Their Relations to Renal Vessels, Aorta, and Vena cava	12
14. Usual Origin of Ovarian Vessels	13
15. Uterine Vessels in Origin and Distribution, Showing Especially Relationship to Left Ureter	14
16. Uterine and Ovarian Vessels; Anastomosis under Uterine Cornu	15
17. Utero-ovarian Anastomosis Shown in Absence of Veins	16
18. Parovarium in Girl of Nineteen	17
19. Radiograph. Arterial Supply of Entire Uterus	18
20. Arterial Supply of Subserous Myoma (<i>M</i>), 1.5 Centimeters in Diameter	18
21. Lymphatic System of Pelvis and Its Communications with Pelvic and Abdominal Lymphatics, and, through Round Ligaments, with Glands under Crural Arch	19
22. Vascularization of Vault of Bladder in Its Peritoneal Portion	20
23. Vascularization of Vesical Mucosa Seen through Cystoscope	21
24. Vascularization of Vesical Mucosa by Right and Left Superior, Middle, and Inferior Vesical Arteries	22
25. Topography of Fixed Part of Bladder	23
26. Sagittal Section of Pelvis with Rectum Drawn Forward Demonstrating Arteries, Veins, and Nerves of Lateral Pelvic Regions	24
27. Sacral Nerves—Lower Roots Palpable by Rectum	25
28. Muscular Structures Forming Floor and Lateral Walls of Pelvis	26
29. Internal Inguinal and Femoral Rings	27
30. Course and Distribution of Internal Pudic Arteries	28
31. Arterial Vascularization of Floor of Pelvis from Without	29

FIGURE	PAGE
32. Muscles of Pelvic Floor in Relation to Rectal and Vaginal Openings . . .	30
33. Action of Levator ani Muscle in Pulling Up Lower Portion of Rectum under Pubic Rami against Symphysis, Effectively Closing Vagina, Giving It Characteristic Shape Shown in Picture	31
34. Interlacement of Anterior Fibers of Levator ani Muscle with Internal Sphincter Muscle of Rectum	32
35. Coronal Section of Pelvis Showing Levator ani and Posterior Pelvic Muscles	33
36. Labium majus	36
37. Labium minus	37
38. Bartholin's Gland	38
39. Cross Section of Urethra with Ducts of Skene's Glands on Right and Left .	39
40. Urethra in Cross Section with Skene's Glands on Both Sides and Below . .	39
41. Normal Vagina	40
42. Vaginal Portion of Cervix	41
43. Normal Cervical Gland	42
44. Early Interval Endometrium	43
45. Endometrium in the Interval	44
46. Premenstrual Endometrium	45
47. Menstruating Endometrium. Third Day	46
48. Menstruating Endometrium. Third Day	47
49. Postmenstrual Endometrium	48
50. Endometrium Showing Intact Surface Epithelium with Compact Layer Filled with Large Decidual Cells	49
51. Section of Fallopian Tube near Uterine Cornu Showing Branching of Mucosal Folds Projecting into Lumen of Tube, Surrounded by Circular Band of Muscle and, Outside of This, Layer of Longitudinal Muscle and Peritoneal Covering	51
52. Fallopian Tube Near Fimbriae	52
53. Tubo-ovarica	53
54. Cortex of Ovary	54
55. Graafian Follicle, Early	55
56. Mature Graafian Follicle	56
57. Corpus luteum	57
58. Corpus albicans	58
59. Gynecological Examining Table	61
60. Brief History Outline—Suggestive Only	62
61. Sagittal Section through Adult Body, Showing Normal Position and Relations of Uterus, Bladder, Rectum, and Abdominal Walls	64
62. Nelson Trivalve Speculum, Open	67
63. Bimanual Examination with Uterus in Artificial Descensus	68
64. Bimanual Examination of Pelvic Viscera	69
65. Rectum Distended with Air with Patient in Knee-Chest Posture, after Which She Returns Carefully to the Dorsal Posture, When Small Intestines Remain in Upper Abdomen, Leaving the Rectum in Close Contact with Broad Ligaments and Facilitating Examination	72
66. Palpating Roots of Sciatic Nerve by Rectum	73
67. Uterine Sound	74
68. Introducing Cylindrical Metal Speculum with Stout Handle for Examination and Treatments in Sims Posture	75
69. Sims Posture	75
70. Knee-Chest Posture, Giving Perfect Exposure in Examining Any Hollow Pelvic Viscera, Rectum, Vagina, or Bladder	76
71. Examination in Knee-Chest Posture Showing Method of Lifting Up Gluteals and Posterior Vaginal Wall, Thus Letting Air into Vagina for Introduction of Speculum or Examination of Bladder	77

FIGURE	PAGE
72. Kelly Conical Metal Speculum for Vaginal Examination and Treatment . . .	77
73. Examination of Vagina, Vaginal Vault, and Cervix in Knee-Chest Posture with Kelly Cylindrical Metal Speculum Having a Stout Handle . . .	78
74. Specula for Examination with Intact Hymen, Especially in Young Women and Children	79
75. Examination of a Child about Six, Showing Facility with Which Entire Pelvis Can Be Palpated by Bimanual Rectal and Abdominal Examination, Owing to Relatively Large Size of Examining Hand	79
76. Method of Introducing Long Rectal Speculum to Examine Entire Length of Lower Bowel	80
77. Inspection of Bowel with Simple Head Mirror Using Reflected Electric Light	81
78. Knee-Chest Posture	82
79. Four Cardinal Projections of Abdomen and Pelvis, Reduced on Same Scale	85
80. Left Figure Shows in Outline, Situated about Periphery, the Various Important Abdominal Organs from Which Tumors May Arise. In Right Figure, Arrows Indicate Directions Taken by These Tumors from Periphery toward Center, Where Resistance Is Least	86
81. Organs on Right, Where Affections Are Liable to Be Confused	88
82. Characteristic Form of Flaccid Abdomen with Ascites	89
83. Cylindrical Flattened Abdomen Characteristic of Ascites	90
84. Early Pregnancy Showing Globular Enlargement of Uterine Body	91
85. A Criminal Abortion, with Separated Elm Tent <i>in situ</i> Partially Perforating Uterine Wall. Septicemia and Death: Removed at Autopsy	98
86. Uterus Perforated by a Tupelo Tent. Peritonitis, Hysterosalpingo-Oöphorectomy, Recovery	99
87. Ferguson Traction Forceps	100
88. Hegar Dilators	101
89. Intra-Uterine Polyp Forceps. Stone Forceps	102
90. Sharp Curet for Removing Uterine Mucosa	104
91. Serrated Fenestrated Curet	104
92. Decidual Reaction in Uterus (Tubal Pregnancy)	105
93. Agglutination of the Labia in a Child	108
94. Agglutination of Labia	108
95. Entire Absence of Vagina, with Indication of Double Hymen. External Genitals Normal	109
96. Rudimentary Uteri, Tubes, and Ovaries in Complete Absence of Vagina	109
97. Left Tube, Ovary, and Uterine Nodule. Tube and Ovary, Normal Size	110
98. Normal Right Tube, Normal Ovary, and Uterine Nodule, Containing Uterine Mucosa and Glands	110
99. Traumatic Atresia of Vagina with Accumulation of Menstrual Secretions Above	111
100. Double Vagina with Thick Fleishy Septum	112
101. Double Vagina and Double Cervix; Septum in Middle	112
102. Double Uterus, Double Vagina, and Planiform Fundus	113
103. Section through Cervices above Vaginal Vault	114
104. Bicornate Uterus with Carcinoma of Both Ovaries	115
105. Portion of Wall of Early Corpus luteum, Removed on Tenth Day of Cycle (Low Power)	121
106. High Power Picture of Corpus luteum Shown in Figure 105	122
107. Wall of Mature Corpus luteum, Twenty-seventh Day (Low Power)	123
108. Corpus luteum Showing Beginning of Retrogression (Low Power)	124
109. Corpus albicans	125
110. Cystic Atretic Follicle Undergoing Obliteration (Above and to Left)	126
111. Cavity Obliterated and Corpus fibrosum Formed	127

FIGURE	PAGE
112. Fetal Type of Uterine Hypoplasia (<i>Uterus rudimentarius</i> or <i>fetalis</i>) (2 and 3), as Compared with Normally Developed Uterus (1)	133
113. Types of Infantile Uteri (2, 3 and 4), in Comparison with the Normal Uterus (1)	134
114. Types of Subpubescent Uteri, Showing Only Slight Differences in Size from Normal Uterus (1)	134
115. Polypoid "Endometritis," Showing Extensive Papillary Overgrowth of Uterine Mucosa	143
116. Typical Endometrial Hyperplasia Consisting of a Heavy Stroma in Which Lies Irregular "Swiss Cheese" Pattern of Glands Lined by a Heavy Epithelium	144
117. Hyperplastic "Endometritis." Section of Polypoid Endometrium as Underlying Muscularis; from Near Middle of Uterine Cavity	145
118. Polyp Causing Hemorrhage in Uterus Harboring Large Fibroid Tumor	146
119. Endometrial Polyp	147
120. Method of Estimating Presence of and Grasping a Submucous Polyp Preliminary to Torsion for Its Removal	148
121. Bisection of Submucous Myoma Showing Avoidance of Peritoneal Inversion into Its Pedicle	149
122. Placental Polyp, Product of Incomplete Abortion, Formed by Contractions of Uterus Acting on Hemorrhage Taking Place Slowly at Placental Site	150
123. Some Causes of Sterility	159
124. Parovarian Cyst	164
125. Insufflation Apparatus Assembled	172
126. Right-sided Subphrenic Pneumoperitoneum	174
127. Smaller Right-sided Subphrenic Pneumoperitoneum	175
128-A, B, C. Kymographic Records of Uterotubal Insufflation in Presence of Normally Patent Tubes.	176
129. Kymographic Record of Uterotubal Insufflation in Presence of Closed Fallopian Tubes	177
130. Roentgenograph after Lipiodol Injection into Uterus and Tubes, Showing Bilaterally Closed Tubes at Fimbria (Clubbed Ends)	178
131. Roentgenograph after Lipiodol Injection into Uterus and Tubes, Showing an Occluded Right Tube at Uterine Tubal Junction and Closed Dilated Left Tube	179
132. Roentgenograph after Lipiodol Injection into Uterus, Showing Total Absence of Left Tube and a Small Stump of Right Tube	180
133. Kymographic Record during Uterotubal Insufflation in Presence of Tubo-uterine Spasm	181
134. Kymographic Record during Uterotubal Insufflation in Presence of Stricture of Tubes in Contradistinction to Spasm	182
135. Vitiligo of External Genitals and Abdomen	189
136. Hematoma Occupying Left Labium majus and Extending Downward on to the Perineum	190
137. Multiple Chancres of Vulva	191
138. Condyloma latum	192
139. Multiple Condylomata acuminata	193
140. Condyloma acuminatum or "Venereal Wart"	194
141. Granuloma inguinale	195
142. Granuloma inguinale	196
143. Tuberculosis of Vestibule	199
144. Chronic Hypertrophic Ulcerative Vulvitis	200
145. Same Case Shown in Figure 144 at Conclusion of Complete Vulvectomy	201
146. Huge Lipoma of Vulva	202
147. Myoma of Round Ligament within Inguinal Canal	204

FIGURE	PAGE
148. Fibronia of Left Labium majus	205
149. Carcinoma of Clitoris Springing from Edge of Condylomata acuminata	206
150. Squamous Cell Carcinoma of Vulva	207
151. Papillary Type of Vulvar Carcinoma	208
152. Relation of Bartholin's Glands to Vagina	209
153. Deep Relations of Bartholin's Glands to Vagina	210
154. Section through Entire Bartholin's Gland	211
155. Cyst of Bartholin's Gland	211
156. Bartholin's Duet Cyst	212
157. Abscess of Left Bartholin's Gland	213
158. Nodule of Tuberculosis of Bartholin's Gland with Pinhole Sinus	214
159. Section of Tuberculous Bartholin's Gland under High Power	215
160. Adenocarcinoma of Left Bartholin's Gland	216
161. Cysts of Left Labium minus	217
162. Adhesions between Prepuce and Clitoris in a Child One Year Old	218
163. Concretion Removed from Beneath Prepuce of Clitoris	218
164. Ovoid Fluctuating Cyst of Clitoris	219
165. Hymen Intact after Nine Years of Married Life	220
166. Insufflator for Coating the Vagina with a Powder in the Knee-Chest Posture	226
167. Membrane Due to Diabetes	229
168. Kraurosis Involving Clitoris and Vulvar Mucous Surfaces, Extending Down over Perineum	231
169. Kraurosis Involving Entire Mucous Surface, Extending Down over Perineum to Anal Orifice	232
170. Dyspareunia	238
171. So-called "Erosion" of Cervix Uteri	241
172. Denudation of Both Lips for Plastic Union. Sutures Laid in Place on Right Side but Not Tied	242
173. Type of Cervix Often Seen <i>facing</i>	242
174. Bilateral Lacerated Cervix with Eversion and Exposure of Cervical Mucosa, Also Fertile Field for Subsequent Cancer <i>facing</i>	242
175. Chronic Endocervicitis	244
176. Cauterization of Cervix	245
177. Separating Mucous Membrane, along Line of Cleavage; No Bleeding	246
178. A. "Cone Excision" of Infected Area Completed but Cervical Canal Not Opened; Cone Used as Traector to Facilitate Placing of Sutures as Shown in B	247
B. Suture 1 Begins at 2:30, Emerges at 3:30; Suture 2 Begins at 1:30, Emerges at 4:30. Suture 2 Should Not Enter, but Must Approach the Cervical Canal	247
179. A. Estimating Extent of Flap Needed and Method of Placing First Stitch of the Double Inverting Stitch as Suggested by Sturmdorf	248
B. Technique of Placing First Half of Double Inverting Stitch; Needle Well Up the Cervical Canal; Good Bite of Cervical Tissue	248
180. Second Half of Double Inverting Stitch	249
181. Anterior and Posterior Double Inverting Stitch Tied; Lateral Sutures Pulled Taut Just Previous to Tying: 1, 2 and 3, 4	250
182. All Sutures Tied; Operation Completed; Only Six Sutures	251
183. Endocervix	252
184. Endocervix	253
185. Vaginal Portion of Cervix	254
186. Central Portion	255
187. Ulcer or "Erosion" on Vaginal Portion of Cervix	256
188. Tuberculosis of Cervix	257
189. Longitudinal Section of External Os	258

FIGURE	PAGE
190. Tuberculous Endocervicitis	259
191. Cervical Polyp	260
192. Elongate Fingerlike Cervical Polyp	261
193. Surface of Cervical Polyp	262
194. Curettings from Cervical Adenocarcinoma	263
195. Tissue Removed for Diagnosis	264
196. Normal Vaginal Outlet in a Nullipara	266
197. Complete Tear of Rectovaginal Septum. Characteristic Pentagonal Form	269
198. Complete Tear of Perineum, with Well-defined Sphincter Pits and Retraction and Thickening of Muscle, with a Deep Dimple Behind	270
199. Method of Demonstrating Relaxed Vaginal Outlet by Hooking Fingers in Vagina on Both Sides and Pulling Outward and Backward	271
200. Test for Relaxed Vaginal Outlet; Posterior Vaginal Wall Drops Well Away from Anterior Wall by Placing Patient in Sims Posture	272
201. Calibrator for Measuring Degree of Relaxation of Vaginal Outlet; Graduation in Centimeters	273
202. Demonstration of Extreme Relaxation	274
203. Relaxed Vaginal Outlet	275
204. Relaxed Vaginal Outlet	276
205. Relaxed Vaginal Outlet	277
206. Relaxed Vaginal Outlet	278
207. Relaxed Vaginal Outlet	278
208. Denudation Outlined by Allis Forceps and Semicircular Incision at Vaginal Orifice Followed by Detachment of Vaginal Flap, Using Scissors as Indicated to Follow Line of Least Resistance between Vagina and Rectum	279
209. Further Detachment of Lower Portion of Vagina by Blunt Dissection with Gauze-covered Finger Reaching Out Laterally to Levator Muscles	280
210. After Resection of Excess of Vaginal Tissue, Levators United by Permanent Silk or Linen Sutures (2 or 3) and Closure of Defect Created by Resection in Vaginal Wall with Continuous Rather Fine Chromic Gut Suture	281
211. Operation Completed	282
212. Denudation in Complete Tear in Which Tissue below <i>A-B</i> Has Been Left to Form an Apron to Be Dissected Loose and Turned Down	283
213. Two Lateral Incisions and Dissection of Apron Serve to Lay Bare Sphincter Area. Muscle Then Picked Up and Dissected Out	283
214. Sphincter Ends by Three Buried Catgut Sutures. Apron Which Protects Wound from Bowel Held by Forceps	284
215. The Vaginal Wound Closed as in Other Perineal Operations	285
216. After Passing All Sutures on Vaginal and Perineal Surfaces, Sides of Apron, <i>A, B, C</i> , Brought Together by Fine Silk Sutures	285
217. Incision in Perineum, Made to Expose Sphincter Ends in Complete Tear; Perineum Restored without Securing Sphincter Union	286
218. Sphincter Ends United and Skin Wound Closed	286
219. Superficial Dissection Pelvic Diaphragm	289
220. Deeper Dissection Pelvic Diaphragm	291
221. Anterior Pelvic Diaphragm Removed	292
222. Partial Dissection of Pelvic Diaphragm	293
223. Superficial Layers of Pelvic Diaphragm Removed	294
224. Sagittal Section through Pelvic Floor	295
225. Connective Tissue and Ganglia of Cervix Uteri	296
226. Planes of Cleavage	297
227. Sagittal Section through Pelvis, Showing Prolapsed Uterus and Bladder	298
228. Separation of Bladder from Anterior Wall of Uterus—"Weak Spot"	299
229. Rent in Uterovesical Fascia (<i>a</i>) and Posturetic Sacculation (<i>b</i>), the Result of <i>a</i>	300

FIGURE	PAGE
230. Prolapsed Ureter and Cystocele	301
231. Complete Prolapsus of Posterior Pelvic Floor	302
232. Relation of Uterus and Bladder in Normal Position	308
233. Dotted Lines Show Uterus and Cardinal Ligaments in Normal Relation, Shaded Lines Elongated Overstretched Cardinal Ligaments When Uterus Is Prolapsed	309
234. Normal Relation between Anterior Vaginal Wall, Cervix, and Bladder . .	310
235. Tearing Away of Vaginal Wall and Fascia at Its Point of Attachment to Cervix, Showing Development of "Weak Spot" as a Result of Injury during Parturition	311
236. Widening of "Weak Spot" with Consequent Loss of Invagination of Cervix and Descent of Bladder with Increased Length of Vaginal Wall and Bladder Base Due to Stretching, Thus Resulting in the Formation of a Cystocele	312
237. Principle Employed to Correct Cystocele in the Childbearing Woman . .	313
238. Principle Employed to Correct Cystocele in the Childbearing Woman . .	314
239. L-shaped Incision Showing Separation of Bladder from Vagina and Uterus and Exposing Base of Broad Ligaments	315
240. Dissection of Uteropubic Fascial Plane ("Bladder Pillars"), Showing Its Origin from Base of Broad Ligaments	316
241. Two Angulation Sutures Tied	319
242. L-Incision Closed by Interrupted Sutures	320
243. Cystocele (Hernia of the Bladder) and Prolapse Demonstrated with Sound in Bladder Showing Its Relations to Cervix and Vagina	321
244. Vaginal Wall Caught with Two Clamps Placed Each Side of Midline, Throw- ing Mucosa into a Transverse Fold	322
245. Blunt-pointed Scissors Passed Closed into Line of Cleavage between Vaginal Wall and Bladder, Then Opened and Withdrawn without Closing, Thus Separating These Structures	323
246. Vaginal Wall Divided with Scissors as Shown, Making a L-shaped Incision	324
247. Vaginal Wall Opened with L-shaped Incision, Exposing Bladder	325
248. Blunt-pointed Scissors Used to Find Line of Cleavage between Bladder and Anterior Uterine Wall and to Start Dissection, Being Careful to Keep Close to Cervix and Avoid Injury to Bladder	326
249. After Line of Cleavage Has Been Found, Gauze-covered Finger Is Used to Push Bladder Upward until Completely Separated from Its Uterine At- tachment	327
250. A. Retractor Lifts Bladder Anteriorly; Peritoneal Reflection between Blad- der and Uterus Is Picked Up with Forceps and Cut with Scissors, Thus Opening Peritoneal Cavity	328
B. Long Catgut Suture Passed through Cut Edge of Bladder Peritoneum and Ends Clamped and Put Aside	328
251. A Pair of "Cat's-Paw" Tenacula May Be Used to Climb up Anterior Sur- face of Uterus to Deliver It by Anteversion	329
252. Fundus of Uterus Delivered; Bladder Up in Pelvis Rests on Posterior Sur- face of Uterus	330
253. To Insure Firm Attachment of Interposed Structures to Subpubic Arch, a Short Stout Needle Armed with No. 2 Tanned or Chromic Gut Is Passed into Periosteum of Pubic Ramus about 2 Centimeters to One Side of Midline and through Uterine Cornua and Tied	331
254. Fundus of Uterus Fastened with Suture to Each Side of Subpubic Arch, Care Being Taken That Suture Includes Periosteum	332
255. Vaginal Incision Closed with Interrupted Catgut Sutures Which Include Uterine Wall	333

FIGURE		PAGE
256.	Vaginal Incision Closed and Y-shaped Drain Made of Rubber Tissue Tied to Small Roll of Iodoform Gauze Inserted as Shown to Drain Oozing Blood, to Be Removed after Forty-eight Hours	334
257.	Sagittal Section Showing Relation of Uterus, Bladder, and Vagina with Rubber Tissue Drain <i>in situ</i> at Completion of Operation of Interposition	335
258.	Scalpel Used to Outline Incision; Flap of Vaginal Wall Dissected Downward off Base of Bladder to Cervix	336
259.	Vaginal Flaps with Attached Fascia Dissected Laterally to Broad Ligaments	337
260.	Cervix Drawn Sharply Upward; Vaginal Attachment Separated from Cervix and Dissected Upward; Peritoneum Opened, Giving Access to Pouch of Douglas	338
261.	Uterosacral Ligaments Developed by Traction on Cervix; Clamp Placed on Each to Insure Identification at a Later Stage in Operation	339
262.	Bladder Separated from Uterus by Blunt Dissection with Gauze-covered Finger until Peritoneum Is Reached	340
263.	Peritoneum Opened with Scissors and Stretched Wide and a Long Suture Passed through Bladder Reflection and Clamped and Placed out of the Way over Symphysis until Needed Later	341
264.	Uterine Fundus Delivered by Successive Sutures or by Cat's-Paw Tenacula as Described in the Watkins Technique	342
265.	Heavy Ochsner-Mayo or Kocher Clamp Placed across Top of Left Broad Ligament Close to Uterus Which Is Cut Away with Scissors to Tip of Clamp, as Indicated by Dotted Line	343
266.	Second Clamp Placed in Front of First, Grasping Broad Ligament in the Same Manner	344
267.	Uterus Still Further Cut Away and Third Clamp Placed; the Tip of This Third Clamp Should Include Base of Broad Ligament (Cardinal or Mackenrodt Ligament) and Uterosacral Ligament	345
268.	Pouch of Douglas Next Obliterated According to Technique for Enterocoele (Chap. XX) and the Six Clamps Brought Together in a Parallel Position and the Cut Ends of Ligaments United by Suture	346
269.	Continuous Mattress-Suture Passed Going through and through Entire Thickness of Ligaments behind Clamps Removed Successfully as Suture Is Passed	347
270.	Suture Tied Securely at Top of Ligaments, Loop Being Left for Traction Upward While Same Suture Is Continued Downward as a Lockstitch, Uniting Cut Edges of Ligaments, and Is Tied to End Left at Start of Suture	348
271.	Suture Previously Passed through Cut Edge of Reflection of Bladder Peritoneum on Opening Peritoneal Cavity Is Used to Attach This Peritoneal Opening to Posterior Surface of United Ligaments, thus Closing Abdominal Cavity with Bladder Entirely Replaced in Pelvis	349
272.	Short, Stout, Round-pointed, Curved Needle, Armed with No. 2 Tanned or Chromic Gut, Is Passed into Periosteum of Pubic Ramus about 2 Centimeters to One Side of Midline of Symphysis, Then through Top of One-half of United Ligaments, and Tied with Care That the Bladder Wall Be Pushed Well Up and Not Caught during the Tying.	350
273.	Right Side Anchored as in Figure 272, and Third Suture Placed in Midline, Catching Tissues on Both Sides of Urethra and Center of United Ligaments	351
274.	Vaginal Incision Closed with Interrupted No. 2 Tanned Gut Sutures, Each Suture Catching up United Ligaments at Their Midline	352
275.	Incision at Vault of Vagina Sutured to Base of Broad Ligaments with Continuous Puckering Stitch	353

FIGURE	PAGE
276. Round Ligaments (and Tubes and Ovaries if Not Removed) Fastened Anteriorly to Stump of Cervix; Uterosacral Ligaments Plicated Posteriorly and Attached to Cervix Stump to Form Platform upon Which to Spread Out Bladder Base	354
277. Bladder Drawn Upward to Fullest Extent and Base Sutured to Anterior Surface of Platform	355
278. Base of Bladder Spread over Stump of Cervix and Sutured to Posterior Surface of Platform	356
279. Free Edge of Bladder Peritoneum Sutured to Posterior Surface of Platform to Complete Operation	357
280. Sponge in Rectum Outlines Rectocele	361
281. Superficial and Fused Fascial Structures Cut through and Levator Muscle and Rectum Separated in Each Suleus by Blunt Dissection with Gauze-covered Finger	362
282. Rectum Separated from Vaginal Wall Well above Area Outlined for Removal	363
283. Fascial Structures Separating Rectum from Levators Clamped Close to Vaginal Wall and Upward for 1.5 Centimeters, and Cut Away at Site of Dotted Lines	364
284. Rectopexy	365
285. Rectopexy	366
286. Cut Edges of Vagina Sutured, Care Being Taken to Include the Two Fascial Stumps in the Upper Sutures to Insure Closure of Space between Them	367
287. Anterior Margins of Levators Grasped with Sponge Forceps and Drawn toward Midline	368
288. A. Levators Sutured Together with Interrupted Cutgut Sutures. Sharp Edge of Colles's Fascia Seen on Each Side of Wound Next Sutured with Continuous Suture, Which at Its Origin Is Passed Wide and Deep to Include Fused Fascial Structures at This Point. Suture Also Catches United Levators	369
B. Skin Margin Then Closed with a Subcuticular Tanned Catgut Suture and End Tied to Fascial Stitieh. The Knot Disappears between Margins of the Incision	369
289. Enterocoele and Rectocele	370
290. Enterocoele	371
291. Enterocoele	372
292. Enterocoele	373
293. Enterocoele	375
294. Enterocoele	376
295. Enterocoele	377
296. Enterocoele with Uterus Retained	378
297. Enterocoele with Uterus Removed	379
298. Vaginal Cyst Occurring Three Years after Repair of Perineal Tear	380
299. Vaginal Inclusion Cyst	381
300. Gartner's Duet Cyst	381
301. Schematic Illustration of Uterus, Tubes, and Vagina, as Well as of Relations of Wolffian and Gartner's Duets to Broad Ligament, Uterus and Vagina	382
302. Rudimentary Vagina in Wall of Well-formed Vagina	383
303. Blind Right Vagina Communicating with Well-developed Right Uterus. Vaginal Cyst Formed in Right Fornix by Gradual Accumulation of Menstrual Secretions	383
304. Cyst of Anterior Vaginal Wall Occurring in Pregnancy	384

FIGURE	PAGE
305. Adenocarcinoma of Posterior Vaginal Wall by Implantation from Unsuspected Adenocarcinoma of Body of Uterus	386
306. Rhabdomyosarcoma. Same Case as Figure 307	387
307. Sarcoma of Vagina in Child 2½ Years Old (Rhabdomyosarcoma)	388
308. Excessive Lower Abdominal Obesity	394
309. Result of Lipectomy	395
310. Retractors	395
311. Self-retaining Retractor for Abdominal Incision	396
312. Stricture of Rectum Due to Pelvic Inflammatory Disease, Seen through Proctoscope, 9.5 Centimeters above Anus	397
313. Vermiform Appendix (<i>App.</i>) Adherent to Large Papillary Ovarian Cyst	397
314. Extensive Pelvic Inflammatory Disease with General Adhesions, Due to Tuberculous Endometritis, Pelvic Peritonitis, Tuberculosis of Both Tubes and of Right Ovary	398
315. Best Type of Needle Holder, Grasping Round Needle with Suitable Eye, Flattened under Eye	399
316. Fergusson Forceps	399
317. Several Forceps	400
318. Clear Space	401
319. Application of Blood-Pressure Apparatus	402
320. Gum Acacia Glucose Solution Apparatus	403
321. Cleansable Syringe with Three-Way Stopcock Used in One-Man Method of Direct Transfusion	404
322. Position in One-Man Method of Donor and Recipient	404
323. One-Man Method Showing Emergency Pipe Line	405
324. Fowler's Method of Drainage	408
325. Gatch Frame	408
326. Site of Puncture (Cross) through Sacral Hiatus Is Center of Triangle Formed by Joining Sacral Cornua and Fourth Sacral Spinous Process	428
327. Sacral Nerves after Resection of Posterior Wall of Sacral Canal	429
328. Sacral Block	430
329. Hysterosalpingo-Oöphorectomy for Large Double Hydrosalpinx with Extensive Adhesions	433
330. Diagram of Several Steps in Hysterectomy by Bisection	434
331. A. Usual Direction of Incisions in Classical Operation for Removal of Uterus	436
B. Amputation of Uterus by Continuous Transverse Incision	436
C. Vertical Bisection	436
D. Horizontal Bisection of Uterus in Cervical Portion	436
332. Stout Museau Forceps for Taking Firm Bite into Fibrous Tissue in Bisection of Uterus or Enucleation of Fibroid Tissue	437
333. Initial Step in Bisection. Lateral Structures Buried in Adhesions. Fundus Grasped by Museau Forceps	438
334. Bisection Started by Cutting Boldly Down in Median Line into Uterine Cavity	439
335. Just before Removal of Right Half of Uterus. Left Half Follows Next	439
336. Uterine Body Removed Leaving Well-cupped Cervix	440
337. Horizontal Section of Uterus as Viewed by Operator through Abdominal Incision	441
338. After Freeing Cervix from Its Vaginal End, It Is Held Up and Bisection Completed from Below Up	442
339. Vaginal Hysterectomy for Cancer of Uterus	445
340. Beginning Operation by Cutting Cervix Loose from Vaginal Vault	446
341. Finger Engaged in Pushing Up Bladder, Detaching It from Cervix	447

FIGURE	PAGE
342. After Freeing Bladder in Front and Opening Culdesac Behind, Base of Left Broad Ligament Exposed by Pulling Cervix to Right and Tied Off by Passing Stout Silk Ligature in Aneurysm Needle	447
343. Vaginal Hysterectomy	448
344. Wide Dissection Exhibiting Base of Broad Ligament and Ureter Above and Division of Broad Ligaments at a Distance from Cervix without Risk of Injury to Ureter	449
345. Vaginal Hysterectomy	450
346. Vaginal Hysterectomy	451
347. Vaginal Hysterectomy	452
348. Anomalous First Sacral Vertebra Partially Sacralized on Right Side . .	458
349. Buckskin Saero-iliac Belt, 2½ Inches Wide	459
350. Front View of Laced Back Corset for Stout Patient, with Two Surgical Steel Reënforcements and a Webbing Pelvic Band to Support Sacro-iliaes and Afford Firm Base for Support of Lumbar Region	460
351. Completed Back Brace, Showing Abdominal Pad, Laced Apron, and Pull-back Straps for Shoulders	461
352. Posterior View	462
353. Lateral Skiagram of a Spondylolisthesis, Showing Forward Displacement of Fifth Lumbar Vertebra on Top of Sacrum	463
354. Spondylolisthesis	464
355. Fracture of First and Third Lumbar Vertebrae	465
356. Tuberculosis of the Left Saero-iliac Joint	466
357. Tubo-ovarian Abscess. Periappendicitis	471
358. Distal Portion of Appendix Adherent to Broad Ligament in Case of Large Multilocular Ovarian Cyst	472
359. Tip of Appendix Adherent to Small Dermoid Cyst of Left Side	473
360. First Step	476
361. Second Step	477
362. Third Step	478
363. Natural Retroflexion Which Cannot Be Corrected on Account of Abdominally Short Vagina	481
364. Acute Antelexion of Uterus with Conical Cervix Tending to Become Tapiroid	481
365. Acute Retroflexion of Uterus Sometimes Cause of Sterility But More Often of Abortion in Early Months	482
366. Kelly Operation	483
367. Uterus Grasped, Held Forward, and Lifted Up, Displaying Left Utero-sacral Ligament to Be Shortened	484
368. Cullen Operation	485
369. Five Most Useful Hard Rubber Pessaries—Slightly Reduced Size Shown by Centimeter Measure Below	489
370. Glass Ball Pessary in Vagina of Aged Woman, Excellently Supporting Prolapsed Uterus and Vagina	490
371. Introducing Ring Pessary, by Drawing Back Posterior Vaginal Wall and Pressing Backward with Pessary Introduced in Slightly Oblique Direction	491
372. Introducing Smith Pessary	491
373. Carrying Smith Pessary into Place	492
374. Showing Ring Pessary in Place and Its Relations to Cervix and Vaginal Vault	493
375. Hard Rubber Ring Pessary at Vaginal Vault Encircling Cervix and Serving to Limit Tendency to Descensus	493
376. Gehrung Pessary	494
377. A Menge Pessary Useful in Some Cases of Prolapsed Uterus	494
378. Myoma	497

FIGURE	PAGE
379. Lipomyoma	498
380. Lipomyoma	499
381. Abdominal Contour of a Single Massive Myoma Removed by Myomectomy	499
382. Large Submucous Myoma with Enlarged, Hypertrophied, Myomatous Uterus with Thick Walls	500
383. Greatly Enlarged Right Ovary Removed with a Myomatous Uterus the Size of a Man's Head	501
384. Myomatous Uterus Weighing 39 Pounds, Seen from Behind	502
385. Uterus with Extensive Myomatous Involvement Chiefly Interstitial and Submucous	503
386. Large Solitary Myomatous Mass Seen from Behind, Uterus with Its Adnexa Sitting on Its Vertex Like a Cap	504
387. Large Sessile Subperitoneal Myoma	505
388. Myoma of Uterine Body	505
389. Myoma of Lower Part of Uterus, Subvesical	505
390. Cervical Myoma with Uterine Body Seated on Its Apex and with Extreme Lengthening of Round Ligaments and Ovarian Vessels	505
391. Myomatous Uterus, Showing Interstitial and Subperitoneal Masses	506
392. Multicystic Myoma	507
393. Enormous Cystic Myoma	508
394. Large Cystic Myoma 31 x 27 Centimeters	509
395. Tumor Seen in Figure 394, Exhibiting Relationship of Thin-walled Cystic Portion to Myomatous Tissue Persisting at Base with Area of Hyaline Degeneration Above	510
396. Copies of Sketches Made by Washington L. Atlee in 1869	511
397. Partially Parasitic Myoma	512
398. Partially Parasitic Myoma	513
399. Parasitic Myoma Completely Detached	514
400. Globular Myomatous Uterus Presenting Form of Pregnant Uterus at Term, with Adaptation of Lower Part to Pelvic Cavity	515
401. Myomatous Uterus, Exhibiting Perfect Cast of Pelvis	516
402. Large Subperitoneal Myoma, Seen from Behind	517
403. Myomatous Uterus Presenting Extraordinary Mimicry of Child in Trans- verse Position	518
404. Pedunculate Myomata, Giving a Perfect Ballottement. Anterior view . .	519
405. Tumor First Outlined on Skin in Anilin or with Eyebrow Pencil, with Such Landmarks as Anterior Superior Spine, Symphysis, Umbilicus, and Mar- gins of Ribs. Glass Plate Laid on Abdomen Covered with Transparent Gauze on Which Markings Visible Beneath Are Traced as Permanent Record to File with History, with Addition of Patient's Name and Date	520
406. Classical Supravaginal Myomectomy	521
407. Supravaginal Amputation by Continuous Ligation and Division down One Side (In Diagram Beginning at Left Cornu), Amputating across Cervix (4), and Finishing by Ligation and Division up Right Broad Ligament	522
408. Large Globular Myoma Choking Pelvis, Compressing Rectum and Bladder, and Forcing Bladder Up into Abdomen	523
409. Same Myoma Lifted Up into Abdomen Out of Its Bed, Showing hypertrophy of Anterior Uterine Wall, and Complete Detachment of Bladder from Uterus and Upper Vagina. Note Compression of Rectum	524
410. Uterus after Extirpation of Myomatous Tumor	525
411. Demonstrates Possibility of Failure through Return of Fibroid Tumors. Same Case as in Figure 410	526
412. Conservative Treatment of Myomatous Uterus	527

FIGURE		PAGE
413.	Same Uterus after Removal of Tumors, Showing Broad Bases of Uterine Tissue to Be Closed by Buried and Interrupted Catgut Sutures, Approximating the Lips of the Wounds as Indicated by Crossed Arrows . . .	527
414.	Myoma Enucleator	527
415.	Large Submucous Myoma	528
416.	Removal of Fibroid Uterus with Tubes and Ovaries	531
417.	Hysteromyomectomy	532
418.	Last Step in Enucleation of Myomatous Uterus	533
419.	Complicated Hysteromyomectomy Showing Extensive Subperitoneal Development	534
420.	Utriculoplasty	534
421.	Sagittal Section Showing Large Fibroid Tumor Occupying Lower Anterior Portion of Uterus	535
422.	Line of Bisection through Body of Uterus and Tumor Indicated by Arrow	536
423.	Uterus Bisected and Tumor Removed from Its Bed	537
424.	Uterine Body with Upper Part of Cap of Tumor Removed after Enucleation	538
425.	Bisection	539
426.	Horizontal Bisection	539
427.	Amputation of Uterus at Levels 2, 3, 4, 5	540
428.	Pelvis Choked by Cup-and-Ball Myoma (<i>M</i>) Compressing Small Intestines, Bladder, Rectum, Vermiform Appendix, and Ureters	540
429.	Torsion of Subperitoneal Pedunculate Myoma Shutting Off Blood Supply	541
430.	Torsion of Globular Myomatous Uterus from Left to Right, Bringing Fundus to Front and Right Tube and Ovary around to Left Side	542
431.	Torsion. Uterus Seen in Figure 430 Untwisted	543
432.	Spontaneous Amputation of Myomatous Uterus	543
433.	Myoma and Carcinoma in Negress	544
434.	Adenocarcinoma of Body with Myomata	545
435.	Large Cervical Myoma with Adenocarcinoma of Body	546
436.	Adenocarcinoma Involving Myoma. Secondary to Body of Uterus	547
437.	Interstitial Myomata. Squamous-Cell Carcinoma of Cervix. Double Pyosalpinx	548
438.	Partially Calcified Interstitial Myoma with Squamous-Cell Carcinoma of Cervix	549
439.	Myoma with Sarcomatous Degeneration	550
440.	Large Cystic Myoma of Left Broad Ligaments, Filled with Pus; Removed by Hysterosalpingo-Oöphorectomy	551
441.	Sagittal Section of Large Necrotic Myoma Communicating by Abscess Cavity with Transverse Colon	552
442.	Case Shown in Figure 441, Anterior View	553
443.	On Dividing Cervix and Drawing Its Surfaces Apart, Uterine Vessels Were Exposed, Caught, and Uterus Completely Detached from Its Pelvic Connection by an Enucleation Proceeding in Directions Indicated by Arrows	554
444.	Suppurating Subperitoneal Myoma Opening into Cecum	555
445.	Tuberculosis of Endometrium in Myomatous Uterus	556
446.	Abdominal Pregnancy, Four Years' Duration, Resembling Large Myoma	559
447.	Bladder Carried High as Umbilicus by Large Myomatous Uterus	561
448.	Large Myomatous Uterus Filling Lower Two-thirds of Abdomen	562
449.	Displacement of the Bladder by Myomatous Uterus with Fundus at Umbilicus	562
450.	Complicated Hysteromyomectomy	563
451.	Dislocation of Right Ureter Forming Angle on Side of Myomatous Uterus	564
452.	Displacement of Right Ureter Ligated and Cut. Subsequent Anastomosis	564
453.	Complicated Large Fibroid Tumor with Adherent Bladder and Large Leashes of Vessels	565

FIGURE	PAGE
454. Complicated Hysteromyomectomy	566
455. Myomatous Uterus with Dermoid Cyst	567
456. Multinodular Myomatous Uterus; Right Parovarian Left Dermoid Cyst	568
457. Characteristic Large Left Ovary Associated with Myomatous Uterus	569
458. Myoma with Greatly Lengthened Ovary	570
459. Squamous Carcinoma of Vaginal Portion of Cervix. Everting or Papillary Form	573
460. Sagittal Section of Specimen Shown in Figure 461 (Slightly Reduced)	573
461. Squamous Carcinoma of Cervical Canal; Inverting Form; Scirrhus	573
462. Sagittal Section of Uterus Seen in Figure 461 (Slightly Reduced), Demonstrating Squamous Growth within Cervical Canal	573
463. So-called Erosion. An Extension of Cervical Mucosa Beyond External Os over Vaginal Portion	574
464. Adenocarcinoma of Cervix	575
465. Partial Obliteration of Cervical Gland by So called Squamous Carcinoma of Cervix	576
466. Squamous Carcinoma of Vaginal Portion of Cervix; Inverting or Infiltrating Form; Medullary with Necrosis	577
467. Cervix of Specimen in Figure 466	577
468. Squamous Carcinoma of Vaginal Portion of Cervix; Inverting or Infiltrating Form; Medullary with Necrosis	577
469. Cervix of Specimen in Figure 468	577
470. Same Type of Growth as Shown in Preceding Illustration, but Later Stage	578
471. Cervix of the Specimen Shown in Figure 470	578
472. Squamous Carcinoma of Cervical Canal; Inverting Form; Medullary with Necrosis	578
473. Cervix of the Specimen Shown in Figure 472	578
474. Same Type of Growth as in Figure 472, but Later Stage	579
475. Squamous Carcinoma of Vaginal Portion of Cervix; Inverting; Medullary with Necrosis	580
476. Approximate Reconstruction Showing Relation between Cancer and Specimen Removed at Operation in Extensive Local Growth. Same Type as in Figures 468, 469, 475, and 485	580
477. Approximate Reconstruction as in Figure 476	581
478. Approximate Reconstruction, Showing Relation between Cancer and Specimen Removed at Operation, in Small Primary Growth with Metastases to Pelvic Lymph-Nodes	581
479. Approximate Reconstruction as in Figure 478	582
480. Adenocarcinoma of Cervix with Extension to a Polyp (a) and to Both Uterine Horns	582
481. Squamous Carcinoma of Cervix with Extension to Bladder and Rectum. Vesicovaginal Fistula	583
482. Approximate Reconstruction Showing Relation between Cancer and Specimen Removed at Operation in Extensive Local Growth	584
483. Squamous Carcinoma of Cervical Canal; Inverting Form; Medullary with Necrosis	584
484. Abdominal and Pelvic Lymph-Nodes	585
485. From Same Specimen as Figure 475	586
486. Double Hydro-Ureter Due to Advanced Cancer of Cervix	588
487. Squamous Carcinoma of Cervical Canal: Probably Everting Form; Pyometra	589
488. Squamous Cauliflower Carcinoma of Cervix from Anterior Lip	590
489. Section of Cauliflower Mass, Seen in Figure 488	591
490. Cervix of Specimen Shown in Figure 474	591

FIGURE	PAGE
491. Approximate Reconstruction Showing Relation between Cancer and Specimen Removed at Operation in Figure 492	592
492. Squamous Carcinoma of Vaginal Portion of Cervix: Inverting Form; Medullary with Necrosis	592
493. Sharp-Cutting Clip Forceps for Removing Bits of Tissue for Microscopic Examination and for Cutting Down Sclerosed Inflammatory Tissues . .	593
494. Retraction of Abdominal Wall	594
495. First Step in Abdominal Operation	595
496. Freeing Uterus Anteriorly	596
497. Exposing and Ligating Uterine Artery	597
498. Freeing Uterus Posteriorly	597
499. Uterosacral Ligaments Cut, and Uterus and Vagina Freed Posteriorly . .	598
500. Wide Excision of Parametrium	598
501. Uterovesical Implantation: Drawing Ureter into Bladder	599
502. Uterovesical Implantation: Suturing Ureter and Sheath (When Well Formed) to Bladder Wall	599
503. Uterovesical Implantation	600
504. Hysterectomy of Cancer of Cervix after Extirpation of Cancerous Uterus to Show What Writer Considers Error in Dissecting Out Ureters and so Risking Slough and Fistula	601
505. Delicate Branching Outgrowths Common in Adenocarcinoma of Body of Uterus	602
506. Adenocarcinoma of Uterine Body, with Metastatic Nodules in Lymph Channels of Left Broad Ligament and Nodule in Left Round Ligament . .	603
507. Early Adenocarcinoma of Body of Uterus	603
508. Adenocarcinoma of Body of Uterus. Scraping from Uterus Represented in Figure 507	604
509. Typical Proliferation of Gland Epithelioma with Formation of New Glands in Adenocarcinoma of Body	605
510. Uterine Myoma Undergoing Sarcomatous Change	607
511. Sarcoma of Body of Uterus	608
512. Endometrial Sarcoma	609
513. Large Endometrial Sarcoma Producing Partial Inversion of Uterus . . .	610
514. Sarcoma Developing Inside Myoma	611
515. Sarcoma in Cervical Stump Two Years after Hysterectomy for Uterine Myoma	612
516. Chronic Epithelioma of Uterus with Multiple Lutean Cysts of Both Ovaries	614
517. Small Fragment of Hydatidiform Mole	615
518. The Various Points at Which Uterine Mucosa Are Found	619
519. Diffuse Adenomyoma of Uterus in Anterior and Posterior Walls	620
520. Section Taken from Uterus in Figure 519	621
521. Adenocarcinoma of Body of Uterus; Submucous Myoma and Small Subperitoneal Adenomyoma	622
522. Beginning Diffuse Adenomyoma of Body of Uterus Associated with Advanced Squamous Carcinoma of Cervix	622
523. Acute Salpingitis with Pyosalpinx	626
524. Acute Salpingitis with Pyosalpinx	627
525. Exposure of Pelvic Peritoneum in Posterior Colpotomy, Cervix Drawn Forward, Vaginal Mucosa Incised, Peritoneum Opened and Abscess Evacuated	630
526. Puncturing a Pelvic Abscess	631
527. The Gonococcus	635
528. Chief Lesions of Gonorrhea	637
529. Venereal Warts	641
530. Tubal Adhesions	642

FIGURE	PAGE
531. Chronic Salpingitis	643
532. Salpingitis isthmica nodosa—Nodular Salpingitis	643
533. Bilateral Hydrosalpinx with Numerous Adhesions Which Kink Tubes and Bind Posterior Surface of Uterus to Rectum	644
534. Hydrosalpinx Containing Nodular S-shaped Calculus in Lumen of Tube, Adherent to Ovary	644
535. Tubo-ovarian Cyst	645
536. Tubo-ovarian Cyst	646
537. Gonorrheal Vaginitis in Children	648
538. Treatment of Gonorrheal Vaginitis in Children	649
539. Dermoid Cysts of Both Ovaries with Chronic Salpingitis	652
540. Ovarian Abscess	653
541. Hysterosalpingo-Oöphorectomy for Large Bilateral Hydrosalpinx with Extensive Adhesions	655
542. Bilateral Salpingectomy, Ovarian Conservation, Closing Raw Areas. Suspension of Uterus. First Step	656
543. Second Step	657
544. Third Step	657
545. Ideal Method of Draining Infected Pelvis	658
546. Tuberculous Left Tube with Adherent Omentum	661
547. Tuberculous Endometrium	663
548. Tuberculous Right Tube with Tubercles Scattered over a Parovarian Cyst	664
549. Tuberculosis of Tubes and Ovaries	665
550. Scrapings from Tuberculous Cervix	666
551. Tuberculosis of Endometrium	667
552. Tuberculous Peritonitis	669
553. Convalescence with and without Drainage in Tuberculous Peritonitis	670
554. Myomata Uteri Complicated by Tuberculosis of the Uterus, Tubes, and Ovaries	671
555. Extra-uterine Pregnancy Gone Some Six or Eight Months beyond Term; False Labor and Death of Child	676
556. Tubal Diverticula Forming Two Rounded Eminences on Upper Border of Ampulla	678
557. Parovarian Cyst Developing beneath Tubo-ovarian Fimbria	679
558. Tube and Ovary Bound Down by Strong Old Adhesions into One Globular Mass	681
559. Parovarian Cyst on Left, Size of Orange	682
560. Sac Laid Open Showing Capacious Cavity and Thin Walls	683
561. Tubal Pregnancy	684
562. Typical Tubal Pregnancy	686
563. Right Uterine Tube Seat of Extra-uterine Pregnancy Ruptured and Discharging Blood into Peritoneal Cavity. Seat of Rupture Plugged by Clots and Villi	687
564. Sac Shown in Figure 563 Cut Open, Showing Little Ovum (Figure below to Right) Surrounded by Mass of Blood-Clots Destroying Vitality of Ovum	687
565. Decidual Reaction in Uterus (Tubal Pregnancy)	688
566. Decidual Cast	691
567. Old Extra-uterine Pregnancy in Which Fetus Was Buried in Ovary and Mass of Adhesions with Adherent Vermiform Appendix	692
568. Lithopedion	693
569. Lithopedion	694
570. X-Ray Film of Full Term Ectopic Pregnancy	695
571. X-Ray Film Showing Fetus with Head at Costal Margin and Feet in Left Iliac Fossa	696

FIGURE	PAGE
572. Ectopic Pregnancy of Right Tube. Free Blood in Abdomen	697
573. Explanatory Diagram of Roentgenogram of Tubal Pregnancy	698
574. Cross Section of Tubal Wall in Ampulla	699
575. Pregnancy in Right Half of Septate Uterus with Hard Left Uterine Body, Associated with Pain and Bloody Discharge from Left Side, Closely Simulating Extra-uterine Pregnancy	702
576. Section from Wall of Tubal Pregnancy Taken from Collection of F. P. Mall	703
577. Tubal Pregnancy	704
578. Extra-uterine Pregnancy	705
579. Ruptured Left Extra-uterine Pregnancy with Large, Free Intraperitoneal Hemorrhage	705
580. Tubal Abortion	706
581. Tube Opened and Partial Extrusion of Clot	706
582. Extra-uterine Pregnancy	707
583. Abnormal Fetus	712
584. Fetus and Umbilical Cord Found Lying among Clots in Abdominal Cavity	712
585. Coagulum Turned Out	714
586. Tubal Abortion	715
587. Bits of Little Fetus Removed and Found Concealed in Clots	716
588. Fully Developed Extra-uterine Fetation	717
589. Sac Emptied of Fetus, Showing Attachment of Placenta to Structures Readily Removed	718
590. Tubo-Interstitial Pregnancy	720
591. Pregnancy in Rudimentary Left Uterine Horn; Rupture; Death	722
592. Diagram Showing Relations of an Ovarian Cyst to Peritoneum of Pelvic Floor and Broad Ligament	727
593. Corpus luteum Cyst	728
594. Atretic Ovarian Follicle Cyst	729
595. Typical Polycystic Ovarian Tumor, with Long Twisted Pedicle	730
596. Multilocular Ovarian Cyst with a Group of Smaller Cysts Projecting into Cavity of Large One, Which Thus Externally Looks Like a Monocystic Tumor	731
597. Polycystic Ovarian Tumor and Parovarian Cyst on Same Side	732
598. Wall of Multilocular Ovarian Cyst Showing Secreting Glandular Spaces and Formation of Pseudomucin	735
599. Unusual Form of Papillomata of Both Ovaries, Seen <i>in situ</i> from Behind	737
600. Cystopapilloma of Ovary, with Papillomatous Masses within Cysts as Well as on Surface	739
601. Solid or Fibroid Papillary Adenoma of Ovary	741
602. Papillary Carcinoma of Ovary	743
603. Ovarian Squamous Cell Carcinoma	744
604. Cystocarcinoma of Unusual Form	745
605. Adenocarcinoma (Colloid Carcinoma) with Numerous Carcinomatous Nodules on External Surface of Unruptured Cysts; Secondary Growths in Omentum	746
606. Large Adenocarcinoma (Colloid Carcinoma) of Omentum, Secondary to Carcinoma of Ovary; Free Border of Omentum Below	747
607. Adenocarcinoma of Omentum, Seen in Section	748
608. Krukenberg Tumor	749
609. Rudimentary Jaw from Dermoid Cyst Containing Molar Teeth, with Wisp of Brown Hair at One Extremity	750
610. Dermoid Cyst	751
611. Contour of Abdomen in Unusually Large Dermoid Cyst	752
612. Complicated Dermoid Cyst of Right Ovary, with Dense Adhesions over En-	

FIGURE		PAGE
	tire Breadth of Omentum with Displacement of Right Tube and Round Ligament	753
613.	Right Dermoid Cyst (<i>D</i>) with Extensive Adhesions	753
614.	Fibroma of Right Ovary with Twisted Pedicle and Ascites	754
615.	Fibroid Tumor	755
616.	Fibroma	756
617.	Calculus of Ovary, Seen on Its Two Surfaces	757
618.	Partially Calcified Fibroma of Right Ovary	758
619.	Angiosarcoma of Left Ovary with Metastasis into Uterus	759
620.	Parovarian Tubules	760
621.	Parovarian Cyst between Ampulla of Tube and Outer End of Ovary	761
622.	Parovarian Cyst, Showing Translucency and Characteristic Relations of Uterine Tube, Greatly Lengthened and Spread Out on Surface of Cyst	762
623.	Parovarian Cyst with Subsidiary Cysts Lying Beneath Tubo-ovarian Fimbria, Weighing Down Fimbriated End of Tube, and Separating It from Ovary, Seen on Right, under Isthmus of Tube	762
624.	Ovarian and Parovarian Cysts of Same Side	763
625.	Parovarian Cyst Bulging Out on Both Sides of Tube and Attached to Isthmus by Bands of Adhesions	764
626.	Parovarian Cyst	764
627.	Parovarian Cyst with Twisted Pedicle; with Hemorrhagic Infarction of the Uterine Tube	765
628.	Subperitoneal Cyst Developed Entirely from Peritoneum	766
629.	Pedicle of Hydatid Tied around Fimbria; Showing also Appearance of White Fatty Degenerated Fimbria	767
630.	Multilocular Ovarian Cyst in a Negress	768
631.	Long Pedicle of Papillary Ovarian Adenocystoma	772
632.	Diagram of Relations of an Intraligamentary Cyst to Anterior and Posterior Layers of Peritoneum of Broad Ligament	773
633.	Adherent Cyst of Ovary; a Mimicry of Intraligamentary Cyst	773
634.	Parasitic Ovarian Cyst of Left Side with General Peritoneal Carcinosis	774
635.	Left Ovarian Cyst with a Twisted Pedicle, Including Uterine Tube, Ovarian Ligament and Round Ligament	775
636.	Pedicle Untwisted to Show Its Anatomical Elements, Extent to Which Round Ligament Is Involved, and Hemorrhagic Infarct	776
637.	Monocystic Tumor of Left Broad Ligament	780
638.	Suppurating Adherent Ovarian Cyst	781
639.	Suppurating Adherent Ovarian Cyst	782
640.	Diagram from a Case of Intraligamentary Cyst, Seen from Above	783
641.	Diagram Showing Manner of Closing up Deficit Left in Enucleation of an Intraligamentary Cyst by a Continuous Catgut Suture from Pelvic Wall to Uterine Cornu	783
642.	Intraligamentary Graafian Follicle Cysts, <i>in situ</i>	784
643.	Intraligamentary Graafian Follicle Cysts	785
644.	Left Dermoid Cyst and Right Multilocular Ovarian Cyst with Twisted Pedicle	786
645.	Fibroma of Left Ovary (<i>MO</i>), with Large Myomata (<i>M, M</i>) of Uterus (<i>U</i>)	787
646.	Papillary Cyst of Both Ovaries with Metastases to Omentum, Abdominal Walls, etc.	788
647.	Carcinoma of Fallopian Tube	790
648.	Carcinoma of Fallopian Tube	791
649.	Wall of Ovarian Cyst 1 Centimeter in Diameter	795
650.	Low Power Photomicrograph of Wall of Fallopian Tube	796
651.	Microphotograph of Endometrium in Lumen of Tube	797
652.	Ovarian Hematoma <i>facing</i>	800

FIGURE	PAGE
653. Endometrial Implants on Terminal Loop of Ileum from Sketch, Natural Size, Made at Operation <i>facing</i>	800
654. Ectopic Endometrium from Wall of Rectum	802
655. Normal Bladder Laid Open by an Incision through Anterior Wall	807
656. Tuberculous Cystitis	810
657. Bent Hairpins Grasped in Artery Forceps and Used as a Speculum to Expose Anterior Portion of Urethra, More Particularly Orifices of Skene's Glands	811
658. A Stout Handle Attached to No. 10 Vesical Speculum, More Convenient than a Shorter One	812
659. Vesical Speculum Introduced with Patient in Knee-Chest Posture	813
660. Cystoscope and Obturator	814
661. Urethral Calibrator and Dilator	815
662. <i>E.</i> Evacuator for Emptying Bladder in Knee-Chest Posture. <i>F.</i> Alligator Forceps for Making Applications or Removing Foreign Bodies or Bits of Tissue from Bladder	816
663. Searcher for Locating Urethral Orifice Similar to Desormeaux's Probe . .	817
664. Patient in a Harness in Knee-Chest Posture for Cystoscopic Examination .	817
665. Holding Vesical Speculum Ready for Introduction; Thumb Presses Obturator Firmly	818
666. Examination of Bladder with Patient in Knee-Chest Posture	818
667. The Left Urethral Labium as It Appears on the Side of the Calibrator Which Is Introduced for the Purpose of Demonstrating Its Presence . .	819
668. Pezzer Catheter in Place in Bladder Drawn Up against Internal Urethral Orifice, Showing Location of Internal Sphincter	822
669. Permanent Suture, Silk or Linen, Grasping Deeper Firm Tissues on Each Side of Neck of Bladder to Bring Sphincter Ends Together as Shown in Figure 670	823
670. It Is Generally Best to Take Catheter Out Before Tying Suture	823
671. Gonorrheal Abscess in Tissues to Left of Urethra Choking Orifice and Displacing It to Right While Pushing Skene's Gland Prominently Forward .	824
672. Concealed Abscess of Skene's Gland	825
673. Large Suburethral Abscess Occupying Anterior Vaginal Wall and Discharging Pus into Urethra through Narrow Slit Near Internal Urethral Orifice	826
674. Diverticulum in Bismuth Injected Bladder Shown by X-Ray	832
675. Exstrophy of Bladder Converted into Carcinomatous Mass	833
676. Preparing Ureter for Implantation	834
677. Incising Peritoneal and Muscular Coats of Intestine and Freeing Mucous Membrane from Muscular Coat	835
678. Sutures Passed and Ureter Being Drawn Down under Intestinal Sutures through Stab Wound in Mucous Membrane	835
679. Duct Implanted and Anchored at Its End Inside Intestine by Traction Suture	836
680. Simultaneous Implantation of Right and Left Ureters	837
681. Diagrams of Bilateral Implantations of Ureters into Pelvic Colon	837
682. Stone in Bladder Shown by X-Ray	839
683. Vesical Calculus, Seen through Speculum	840
684. Removal of Calculus through Vaginal Incision Made from Cervix Uteri to Trigonum	840
685. Rapid and Safe Method of Opening Base of Bladder	841
686. Phosphatic Calculus Formed upon Hairpin in Bladder	842
687. Section of Vesical Calculus of Bladder Removed from a Girl Eight Years Old	842
688. Vesicovaginal Fistula Caused by a Pessary; Sagittal Section	844

FIGURE	PAGE
689. Scissors for Paring Edges of Vesicovaginal Fistula	850
690. Classical Operation, Silkworm Gut Sutures Inserted Transversely	851
691. Vesico-uterine Fistula Treated by Dissecting Bladder Free from Uterus and Sewing up Fistula	855
692. Pyuria Due to Suppurating Adherent Dermoid Cyst Opening into Bladder	857
693. Three Styles of Self-retaining Catheters	858
694. Section of Bladder Wall Showing Changes in Acute Cystitis	859
695. Suppurative Exfoliative Cystitis	860
696. Extensive Pseudogland Formation in Chronic Cystitis Cystica	861
697. Extensive Calcareous Deposits in Bladder in Chronic Cystitis	862
698. Cystoscope Used to Measure and Plot Out Area of Disease	864
699. Irrigation of the Bladder by Two-Way Catheter	867
700. Apparatus for Distention	868
701. Chart Showing Results of Distention Treatments	869
702. Incision for Thorough Drainage of Bladder, Usually Made with Knife Blade Set on Handle at an Angle, Enlarged Fore and Aft, Guarding Urethral Orifice by Introducing Index Finger to Ascertain Its Position	870
703. Suture of Vesical to Vaginal Mucosa to Maintain Permanence of Opening Which as a Rule Should Be Made Somewhat Larger than Shown	871
704. Dudley's Operation, Opening Bladder for Drainage Using Blunt Curved Forceps through Urethra—Patient in Lithotomy Posture—Forceps Push- ing Bladder Well Forward While Incision Is Made	871
705. Bilateral Ureteral Obstruction Following Use of Radium to Control In- operable Cervical Carcinoma	874
706. Same as Figure 705. Left Side	875
707. Slight Changes in Kidney from Stasis Due to Stricture Demonstrated Clin- ically in Broad Ligament Region	877
708. Same as Figure 705. Microphotograph of Ureteral Wall a Few Centimeters below Kidney	878
709. Evidences of More Advanced Damage to Kidney	878
710. Same Case as Figure 709	879
711. Kidney Section from Bilateral Stricture of Ureters in Child of Three . . .	879
712. Section of Ureteral Wall through Stricture of Right Ureter, 4 Centimeters above Bladder	880
713. Higher Magnification of Block Outlined in Figure 712, through Stricture of Right Ureter	880
714. Urogram in Woman of 38, with Dysmenorrhea, Left "Ovarian Neuralgia" of Long Duration, Dyspareunia, and Invalidism for One Year with Re- curring Right Pyelitis and Almost Constant Bladder Distress	885
715. Pyelogram of Patient (age 30) with Persistence of Symptoms after Bi- lateral Oöphorectomy	887
716. Urogram of Patient of 23 with Dyspareunia and Apparent Errors in Diagnosis	889
717. Pyelogram of Patient of 47 with Menorrhagia Probably Influenced by Uter- ine Fibroid, Menopausal Age, or Dyscrasia Due to Ureteral Stricture . . .	891
718. Urogram of Patient of 50 with Intermittent Attacks of Complete Incon- tinence	892
719. Spiral or Corkscrew Wax Tip Often Traverses Stricture Areas Impervious to Smaller Filiforms or Pointed Tip Catheters	895
720. Bulbs Illustrating Effects of Stricture on Pliable Wax When Bulb Is Too Large to Pass Entirely Through	896
721. Method of Making Wax Bulb	898
722. Papillomatous Tumor of Bladder; Tips of Papillæ and Fingerlike Pro- longations	904

FIGURE	PAGE
723. Papillary Carcinoma	905
724. Malignant Papilloma	905
725. Squamous-Cell Carcinoma Developing on Exstrophy of Bladder	907
726. Rare Adenocarcinoma Developed from Glands of Linbeck and Brum	908
727. Rhabdomyosarcoma in Girl of Twelve	909
728. Pedunculate Papilloma in Front of Right Ureteral Orifice	910
729. X-Ray of Bladder Injected with Bismuth Subnitrate, Suspended in Water	911
730. Method of Using Desiccation or Coagulation through Air-distended Cysto- scope	914
731. Heavy Lead Cylinder and Radium Carrier Employed for External Radiation	915
732. Schematic Drawing, Showing Use of Applicator and Implanting Injector through Kelly Open-Air Cystoscope	916
733. Radium Carrier; Punch Injector; Long, Straight Needles; Calibrated Sound	917
734. Young Radium-carrying Cystoscope	918
735. Two Types of Needles for Implantation	936
736. Two Forms of Needle Threaded and Ready for Use	937
737. Decrease in Intensity of Radiation Due to Absorption in Tissue and to Spherical Dispersion When Applicator Is 12 Centimeters from Surface	938
738. Radium Apparatus Employed in Treating Cervical Cancer	939
739. Diagram Showing Progressive Disappearance of Fibroid First Treated October, 1913	950
740. Sound, Tubes, and Wax for Intra-uterine Treatment of Fibroids and Bleeding Cases	951
741. Gas Tube	956
742. Coolidge Hot-Cathode Tube	957
743. Coolidge Water-cooled Tube	958
744. Correct Pneumoperitoneum of Pelvic Organs and Proper Posture for Skiagram	967
745. Chronic Bilateral Salpingitis; Right Hydrosalpinx; Patent Left Tube	968
746. Bilateral Salpingitis; Adhesions on Left; Patent Tubes	969
747. Bilateral Tuberculous Salpingitis with Closed Tubes	969
748. Bilateral Tubo-ovarian Disease with Closed Tubes	970
749. Two Types of Machines for Ultraviolet Therapy	972
750. Three Types of Active Electrodes Used in Treatment of Lesions of Vulva, Urethra, Vagina, and Cervix	975
751. Electrode Used in Treating Tumors of Bladder through Open-Air Kelly Cystoscope	976
752. Inactive Electrode (Pad) beneath Buttocks of Patient	977
753. Desiccating Effect of Current; Cells Dehydrated, Elongated with Spindle- shaped Nuclei, Have Not Lost Their Outlines	978
754. Coagulation of Tumor Cells into Homogeneous, Granular Mass by Heavy Bipolar Current	979
755. Corbus Thermophore Consists of Thin Nickel-plated Shell (A) Closed at One End, Measuring 5 Millimeters in Diameter; Hard Rubber Shield (B) Measuring 15 Centimeters by 1 Centimeter, Is Attached, Allowing an Extension of 4 Centimeters for Insertion in Uterus; an Insulated Terminal (C) for Attachment of Cable, Supplying Current; Thermometer (D) Inserted to Full Depth of Shell and Readings Taken from Exposed Portion	980
756. Effect of Acusection (Endotherm Knife) Current	981
757. Thermophore in Treatment of Disease of Female Urethra	982
758. Application of Diathermy in Gonorrheal Endocervicitis	983
759. Carcinoma of Vulva before Treatment	986

FIGURE	PAGE
760. Same as Figure 759 after Treatment with Electrodesiccation (Monopolar Endothermy) under General Anesthesia	986
761. Carcinoma of Cervix Uteri	987
762. A. Electrode in Place Coagulating Carcinoma of Cervix. B. Involved Area after Coagulation. C. Implantation of Radium Needles above Coagulated Area. D. Tube of Radium Emanation Inserted into Cavity, Remaining after Coagulated Tissue Has Been Removed	988
763. Sarcoma of Urethral Orifice	989
764. Diagram Showing, on Left, Ureter Passing through Bladder Wall, with Ostium Obstructed by Papilloma. On Right, Ureter Is "Burned Back" by Diathermy, Including Removal of Papilloma	990
765. Treatment of Bladder Papilloma through Hard Rubber Open-Air Kelly Cystoscope, Using Monopolar or Bipolar Current	990
766. Clark's Method of Coagulating Pedicle of Bladder Papilloma through Suprapubic Incision, Using Tonsil Snare as Active Electrode	991
767. Coagulation of Blood-Vessels	993

PLATES

PLATE	FACING PAGE
I. Pruritus Vulvæ	232
II. Multiple Angiomyomatous Foci in Myoma	550
III. Acute Pyosalpinx	642
IV. A. Hydrosalpinx simplex. B. Hydrosalpinx follicularis	648
V. Hydrosalpinx simplex	650
VI. Tuberculous Uterus and Tubes	662
VII. Endometrial Tuberculosis, Fairly Early	666
VIII. Section of Small Nodule from Inner Surface of Tumor (Fig. 600)	738
IX. Papillary Ovarian Cyst with Sarcomatous Nodules	740
X. Hemorrhagic Ovarian Cyst	772
XI. Caruncle of Urethra	828
XII. Cancer of Cervix	932
XIII. Cancer of Cervix	942
XIV. Cancer of Cervix	952

GYNECOLOGY

CHAPTER I

ANATOMY

HOWARD A. KELLY

INFANTILE AND ADULT PELVIS

ABDOMINAL MUSCLES

Semilunar Line

External Oblique Muscle

SMALL INTESTINES

LARGE INTESTINE

PELVIC VISCERA

Great Vascular Trunks of Lower Abdomen and Pelvis

Intrinsic Blood Supply of Uterus

Lymphatic System

Bladder

SAGITTAL SECTION OF PELVIS

PELVIS THROUGH SUPERIOR STRAIT

PELVIS FROM BELOW

CORONAL SECTION OF PELVIS

PELVIC FASCLE

Anatomy and physiology are as essential to the gynecologist as a familiarity with the general principles of surgery; the foundation stones of successful work are laid by envisaging the relations of the parts to be dealt with so clearly that the operator divides layer from layer almost as though the investing tissues were transparent. Without this thorough knowledge of the component parts of the pelvis and abdomen in their mutual relations, to be gained only by dissection, surgery is not a science and an art but a haphazard procedure trusting to the favors of the fickle goddess of luck; without a knowledge of physiology, an operator often ruthlessly sacrifices organs whose functional activity is essential to the well-being of the patient. I emphasize these facts because so many attempt to enter the ranks of gynecology from general practice with only such meager training as is often gleaned in our schools—a knowledge insufficient to make safe operators.

I do not attempt here to delineate pelvic anatomy as laid down in current manuals but consider the pelvic viscera, first, as they are approached in an operation from above and, then, from below, from the practical standpoint. Descriptions of the relations of organs are so lifeless without pictures that I confine the text for the most part to the elucidation of topographical drawings, all but two from original dissections, besides several from the recent original studies of the circulation of the uterus by J. A. Sampson.

Infantile and Adult Pelvis.—From birth to sexual maturity, there is a gradual progressive change in the position and relations of the pelvic viscera. In the infant, the bladder and the uterus can only be named pelvic viscera

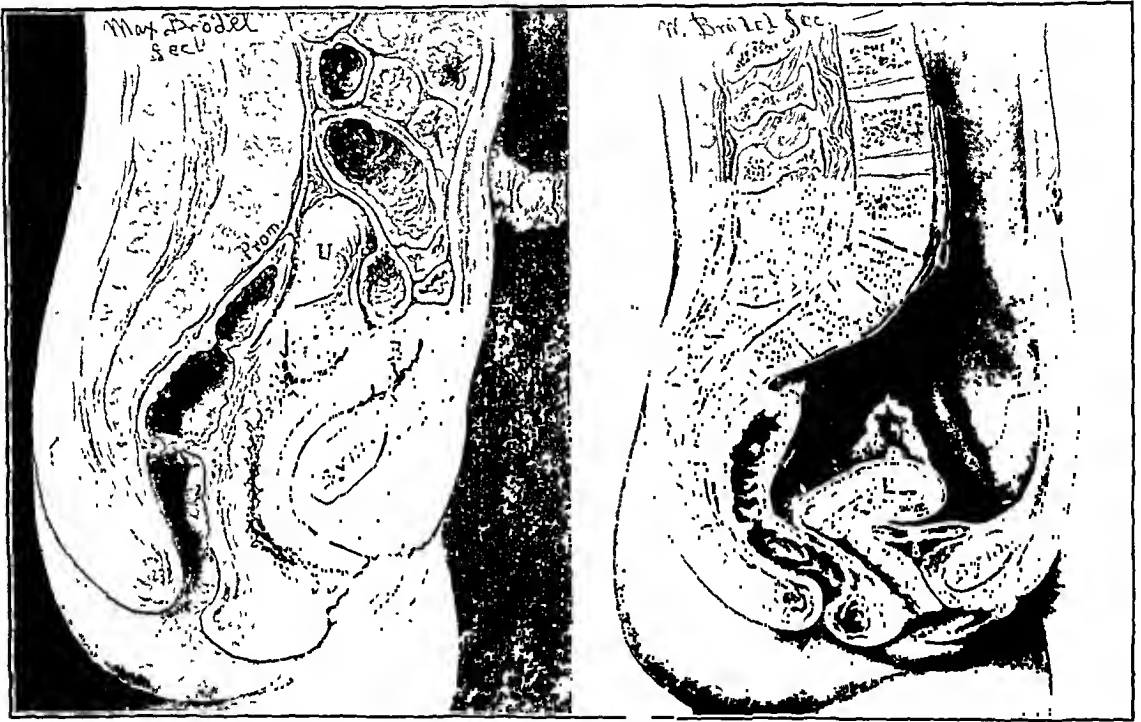


FIG. 1.—INFANTILE PELVIS, SAGITTAL SECTION. $\times 1$.

FIG. 2.—PELVIS OF ADULT WOMAN, SAGITTAL SECTION, REDUCED TO CONFORM TO INFANTILE PELVIS FOR COMPARISON.

prospectively, for at this period both lie above the pelvis in the abdomen, as shown in the frozen section of a newborn child.

The comparison between the infantile and the adult pelvis is visualized by placing a child's pelvis beside that of a fully developed woman reduced to the same scale, Figures 1 and 2. One of the most striking differences is the alteration in the direction of the axis of the pelvis: in the child, a simple direct extension of the abdominal cavity, and at maturity set at a marked angle. While in the infant, the uterus with large cervix and small body lies almost wholly within the abdomen, compressed between rectum and bladder in an upright position, without any angle of flexion, in the adult it lies anteposed within the pelvis, at an acute angle with the vagina, and with a well-developed corpus and rela-

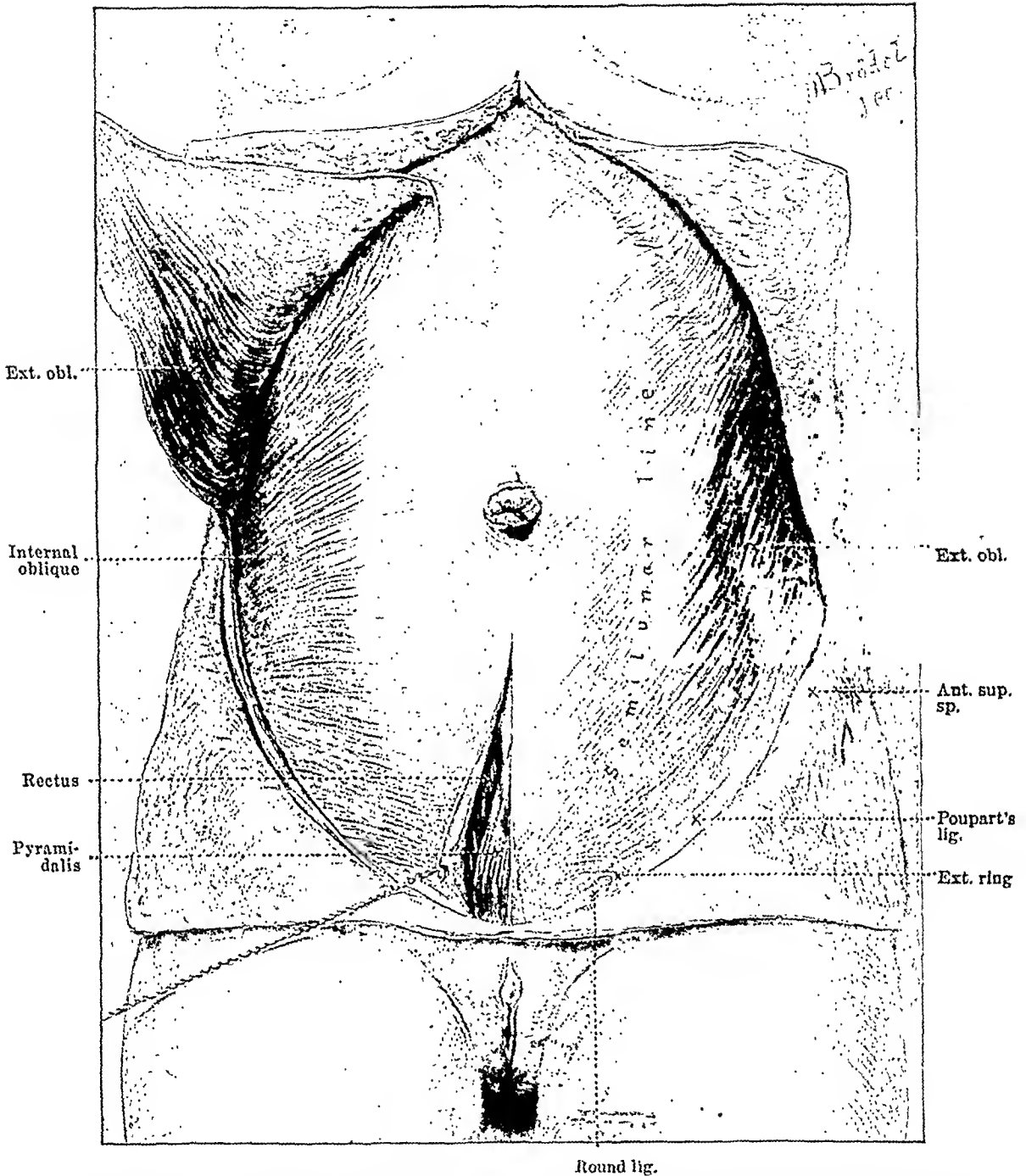


FIG. 3.—ABDOMINAL MUSCLES, SKIN AND FAT REFLECTED SHOWING EXTERNAL OBLIQUE, SEMILUNAR LINE, AND FASCIA COVERING RECTUS ON LEFT. ON RIGHT, EXTERNAL OBLIQUE REFLECTED UPWARD SHOWING INTERNAL OBLIQUE. PYRAMIDALIS LIES WITHIN RIGHT RECTUS SHEATH BELOW.

tively small cervix. In the infantile figure, the fundus rests on the last lumbar vertebra, covered by the mesentery of the small intestine. The cervix is large and the long rugose vagina lies just anterior to the axis of the pelvis. The thick-walled bladder occupies the anterior part of the abdomen just above the symphysis. The almost straight rectum exhibits three cavities divided by two valvelike folds of mucosa, the lower just above the middle of the vagina, on a line drawn from the lower border of the symphysis to the coccyx, and the upper

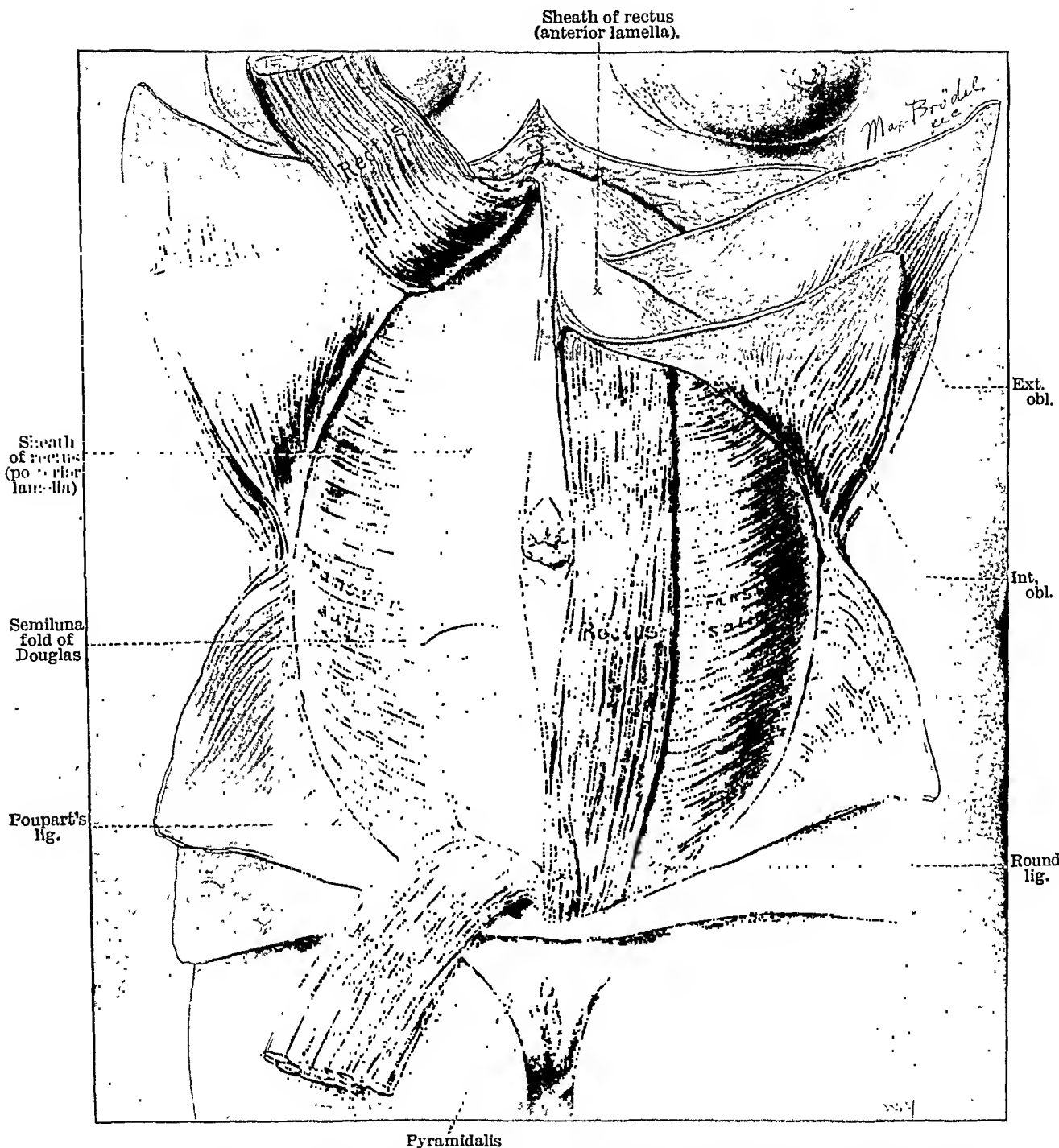


FIG. 4.—ON LEFT INTERNAL OBLIQUE REFLECTED, TOGETHER WITH EXTERNAL OBLIQUE AND SHEATH OF RECTUS, TO SHOW TRANSVERSALIS MUSCLE AND LEFT RECTUS. ON DIVIDING RECTUS IN MIDDLE, AS ON RIGHT SIDE, TENDINOUS POSTERIOR SHEATH IS SEEN ABOVE, ENDING AT SEMILUNAR LINE BELOW UMBILICUS.

opposite the greatly elevated vaginal vault. The umbilicus, as in the adult, is opposite the second lumbar vertebra.

Abdominal Muscles.—Figure 3 shows the oval contour of the abdominal cavity and the external and internal oblique muscles; the right and left recti form strong contractile bands, uniting symphysis to cartilages of the fifth,

sixth, seventh ribs, and ensiform process, bound practically in one in the median line by the linea alba and bordered at their outer margins by the strong fibrous semilunar lines. The rectus muscle has three transverse tendinous intersections, one at the umbilicus and two above. The sheath of the right rectus, opened below, shows the right pyramidalis muscle, arising from a narrow base at the symphysis and extending one-third the way up to the umbilicus, lying upon the rectus.

Semilunar Line.—The semilunar line lies about halfway between the median line and the left lumbar region as viewed from the front. The external oblique muscle appears on the left side with its fibers radiating from costal margin and left lumbar region downwards and inwards toward the rectus. Below, just above Poupart's ligament, the parting of the fibers is seen at the external ring with the round ligament emerging. The position of Poupart's

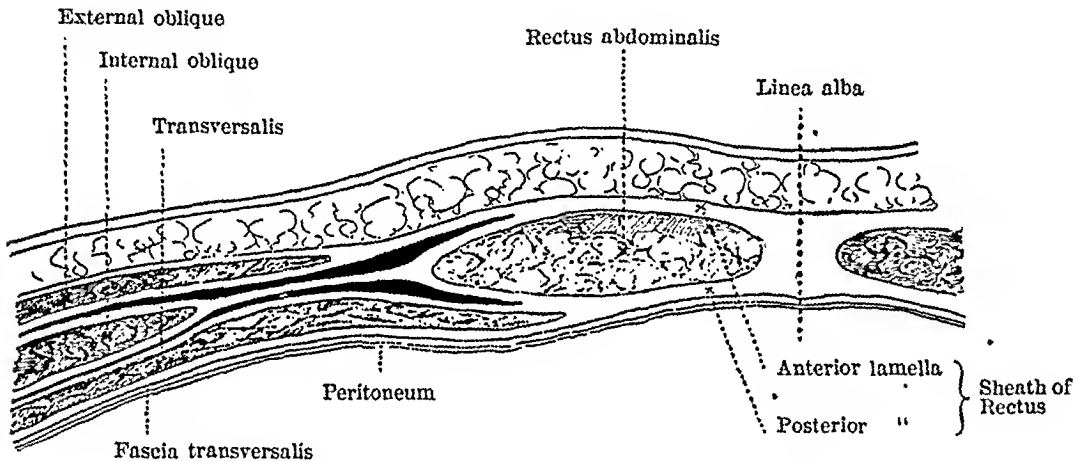


FIG. 5.—TRANSVERSE SECTION ABOVE SEMILUNAR FOLD.

ligament between the spine of the pubis and the anterior-superior spine of the ilium is indicated by the white band.

External Oblique Muscle.—On the right, the external oblique is reflected upward to expose the internal oblique muscle, the tendinous aponeurosis being detached from the anterior lamella of the sheath of the rectus as far forward as the dissection could be carried.

In Figure 4, the deepest of the three muscular layers is formed by the right and left transverse muscles with fibers of horizontal trend. Both external and internal oblique muscles are reflected, the external turned up and the internal divided and turned both up and down. The left rectus muscle lies exposed with its pyramidalis below; on the right, the rectus is divided in the middle to show the transversalis fascia forming a sheath posteriorly, extending from the costal margin above down to the semilunar fold of Douglas about 3 centimeters below the umbilicus. Below the fold the convolutions of the intestines are visible through the thin retroperitoneal fascia and peritoneum.

In Figures 5 and 6, the scheme of the relations of the muscles and

fascia of the abdominal walls, as seen in transverse section, is according to Braune. Figure 5, a section above, and Figure 6, below the folds of Douglas, exhibit the relations of the recti to the transverse and the internal and external oblique muscles.

In the section above the folds of Douglas, Figure 5, it is important to notice the relations of the aponeuroses, indicated by the white spaces between the muscles. The division of the fascia of the internal oblique is evident at the rectus, as one lamella passes in front to unite with the fascia of the external oblique and the other passes posteriorly to the transversalis tendon, to continue as a conjoined tendon uniting with its fellow.

In Figure 6, there is quite a different arrangement of muscle tendons; the external oblique remains about the same, while the internal advances much closer to the rectus, and the transversalis, instead of passing behind the rectus,

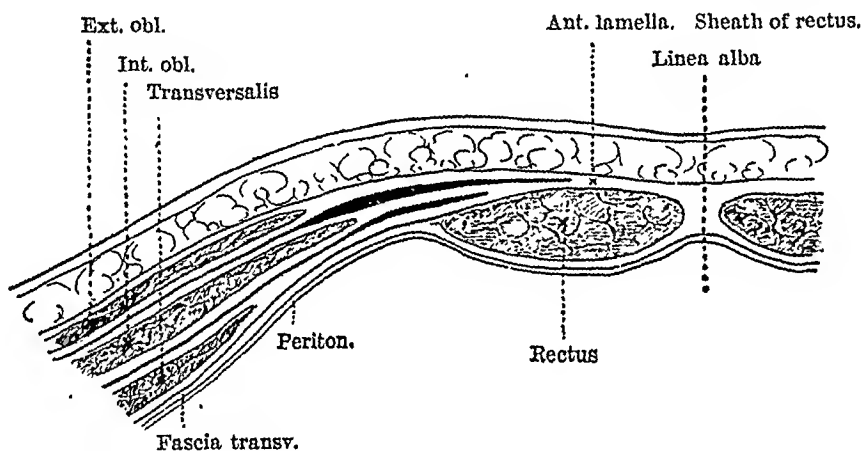


FIG. 6.—TRANSVERSE SECTION BELOW SEMILUNAR FOLD, SHOWING ABSENCE OF POSTERIOR FIBROUS SHEATH BEHIND RECTUS AS WELL AS DIFFERENCE IN RELATION TO THE MUSCLES.

as in Figure 5, is displaced back toward the lumbar region. In Figure 6, the fasciae of the external and internal obliques blend at a point nearer the median line, and the internal oblique failing to split sends its tendinous aponeurosis in front of the rectus along the transversalis. After cutting through the fascia in the median line, we commonly encounter an azygous vein (sometimes two).

Small Intestines.—Figures 7 and 8, drawn directly from the subject, exhibit the topographical anatomy of the small intestines as investigated by D. Sernoff (*Internat. Monatschr. f. Anat. u. Physiol.*, Bd. 1894, 11) and elaborated by F. P. Mall whom I follow. The letters on the small intestines associate them in their natural groups, each of which is so attached to its mesenteric lamellæ that by picking up a bunch of lamellæ at its base near the vertebral column, the entire group of small intestines attached to it is also lifted and isolated.

Beginning at the duodenum, Figure 7, note the lamellæ under the left splenic flexure of the colon included between the letters A and B; from this

group the mesentery crosses the vertebral column to the right to form a series of folds under the right hepatic flexure included between B and C; crossing the vertebral column once more to the left, the next group lies in the left iliac fossa between C and D; the fourth and last group, between D and E, fills the lower abdomen and right iliac fossa. It is important to note the straight line of the



FIG. 7.—FOLDS OF MESENTERY SHOWING USUAL ORDERLY ARRANGEMENT IN GROUPS FOLLOWING LETTERS A, B, C, D, E.

Note Henke fissure between B and C.

terminal portion as it ascends from the pelvis to the head of the colon as the mesentery rapidly shortens from its extreme length down to obliteration. The loops of the intestines which in all cases cross the median line are those going from the first to the second and from the second to the third groups. The basal attachment of the mesentery is oblique, extending from above downward and from left to right, Figure 9, in striking contrast to the more horizontal at-

out of forty examined by Mall. To facilitate the study of the four groups of intestines, identical letters mark corresponding divisions. The figures accompanying the letters in Figure 8 follow the course of the bowel. Sernoff found that the exposed peripheral parts of the small intestines constitute about one-sixth of the canal from duodenum to cecum, the average entire length being 537 centimeters. Group B, Figure 8, lies under the left splenic flexure of the colon, and a hand grasping the mesentery at this point picks it up *en masse*. Group C (same figure), under the hepatic flexure of the colon, can be picked up by carrying the hand down to the mesentery on the right side

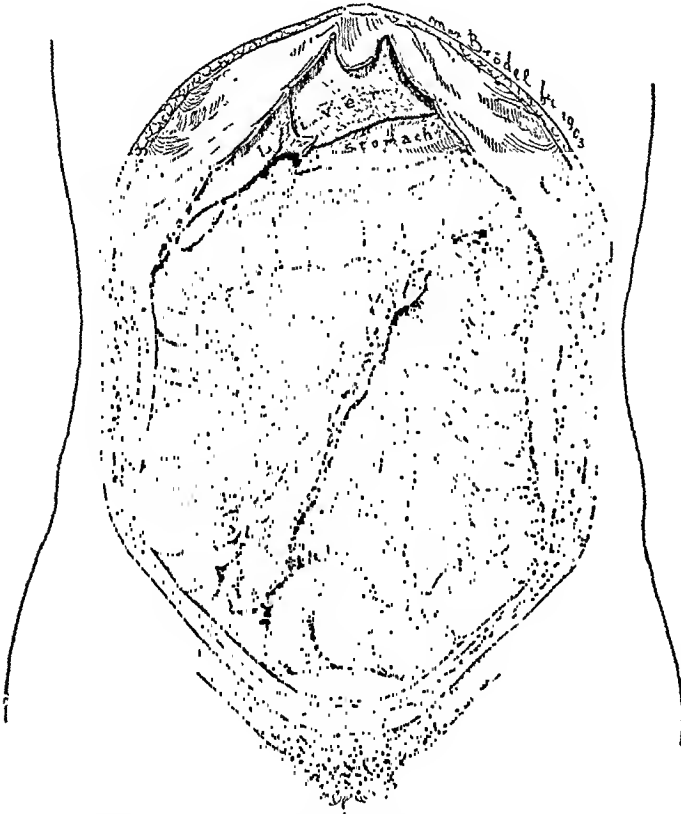


FIG. 9.—NORMAL POSITION OF ILEOCECAL APPARATUS.

Appendix usually not visible until cecum is lifted out of iliac fossa.

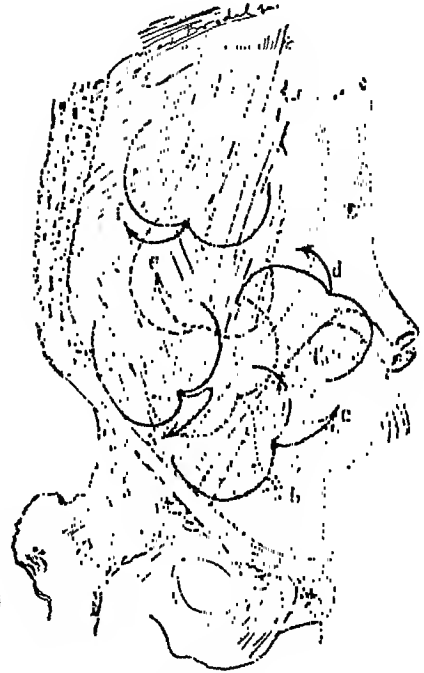


FIG. 10.—POSITIONS OF MODERATE DISPLACEMENTS OF APPENDIX, WHILE STILL IN RIGHT LOWER QUADRANT OF ABDOMEN.

between the colon and small intestines; by throwing this group over to the left, the whole of the right renal region lies exposed. Below B and above C there is a natural deep fissure between the bowels (Henke's) extending back to the psoas muscle.

The following variations are common:

Group C is displaced from its position under the right hepatic flexure into the left flank.

Group B crosses the median line and occupies the position of Group C under the hepatic flexure, while Group C goes to the left.

Group C goes down to the left and Groups B and D go across and ascend on the right to fill its place.

Anatomical drawings often err in representing the anterior abdominal wall as too distant from the lumbar vertebræ; the separation varies according as the distended intestines float up and push the wall forward 2, 3, 5, or more centimeters from the sacral promontory, or as they contract they retire to the upper abdomen and into the right and left flanks.



FIG. 11.—THE PELVIC VISCERA.

Uterus lying a little to left, crowded over by rectum somewhat more than usual to right. In angles at sides lie uterine tubes and ovaries. Bladder bordered in front by round ligaments.

In emaciated patients, the anterior wall is applied to the vertebral column which stands out visibly. In one woman, after the removal of an extensively adherent parovarian cyst, the collapsed walls actually adhered to the vertebral column and caused much discomfort in the convalescence. It is well to turn such a patient early from side to side.

Large Intestine.—A familiarity with the anatomy of the terminal portion of the ileum is important to the gynecologist as the part of the intestinal tract

most liable to displacements and oftenest involved in pelvic inflammatory processes.

Figure 9 represents the cecum lying in the right iliac fossa with its longitudinal fibers leading to the root of the vermiform appendix, which rests on the common iliac artery and the psoas muscle. The ileum climbs straight up out of the pelvis and over the sacro-iliac junction to its terminus in the cecum, an arrangement due to the triangular form of its terminal mesentery which ends at the cecum in a point. See also Figure 7.

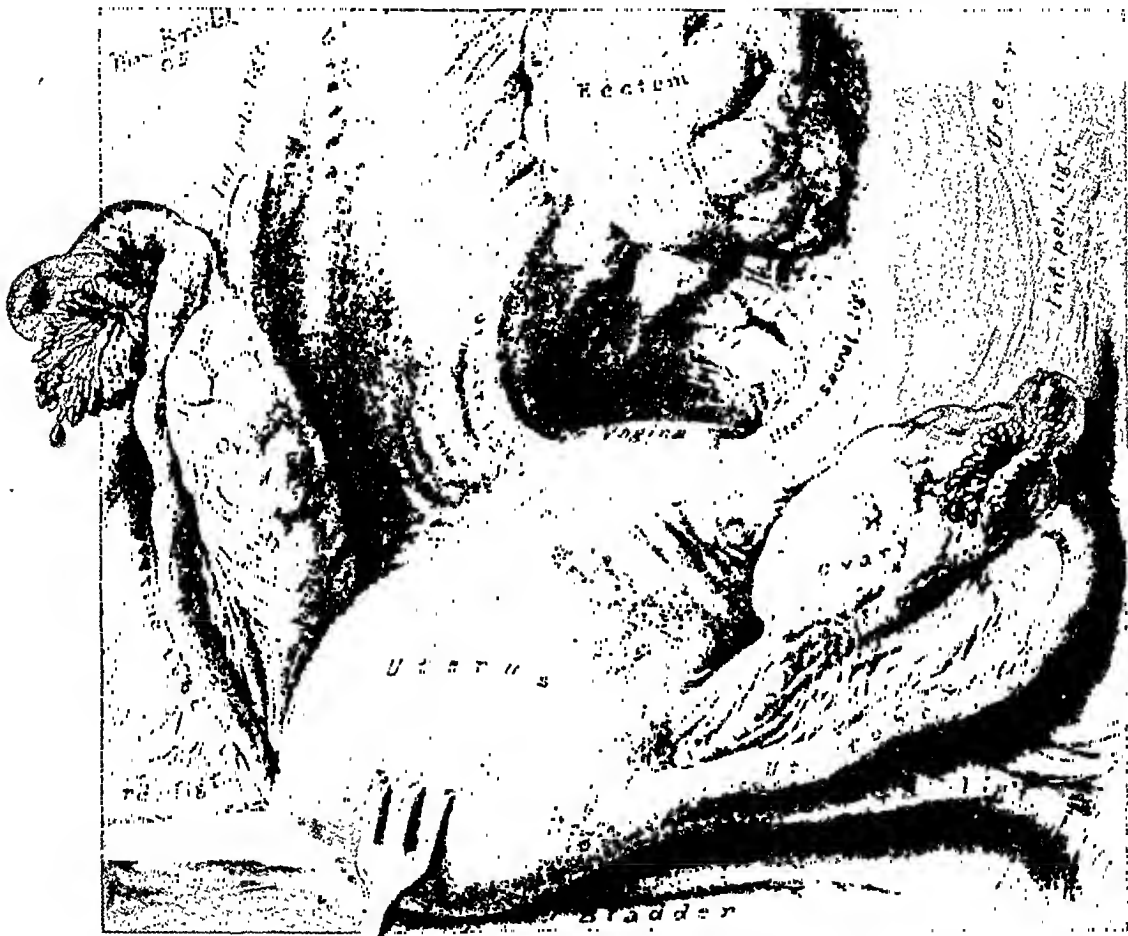


FIG. 12.—UTERUS PULLED OUT OVER SYMPHYSIS TO DISPLAY LATERAL STRUCTURES.

Note especially uterosacral ligaments below and Douglas's cul-de-sac. Ureters seen through peritoneum at sides.

Figure 10 shows various positions in the right lower quadrant in which the appendix is found: *a, b, c, d* are determined by the length of the mesentery; *e* and *f* are congenital due to incomplete descent.

Pelvic Viscera.—The pelvic viscera—uterus, rectum, bladder, tubes, and ovaries—often appear through the superior strait as if carefully and snugly packed away to avoid all waste of space. The drawing, Figure 11, is *ad naturam* and represents a fair average.

The bladder in front is moderately distended, somewhat gibbous, fuller

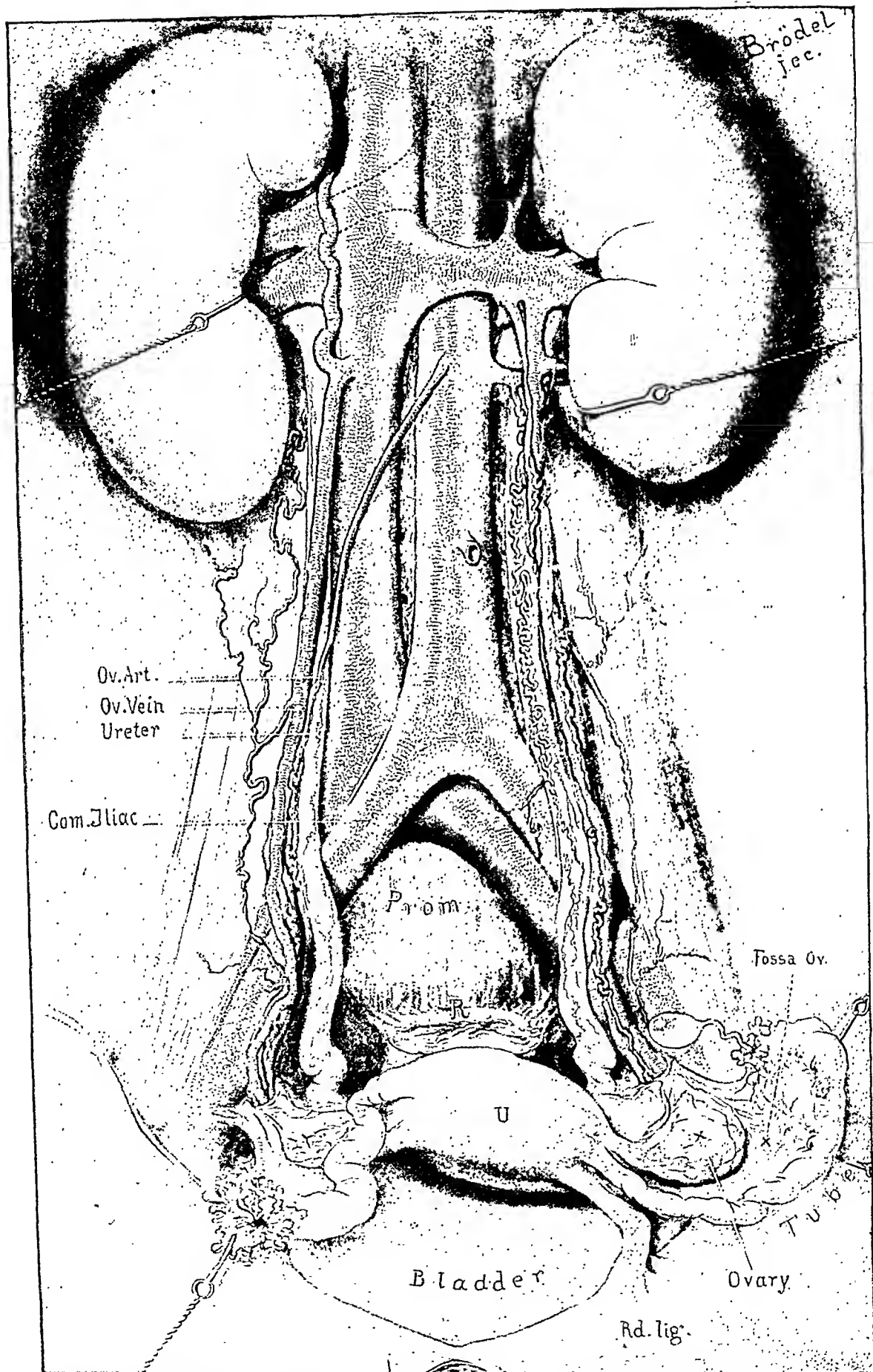


FIG. 13.—GREAT VASCULAR TRUNKS OF LOWER ABDOMEN WITH OVARIAN VESSELS IN THEIR RELATIONS TO RENAL VESSELS, AORTA, AND VENA CAVA.

on the right. The rectum drops into the pelvis to the right of the sacral promontory, occasioning a slight left lateral displacement of the uterus nested between it and the bladder, with a resultant lengthening of the right and shortening of the left round ligament. The tubes and ovaries on each side fill the corners left between rectum, uterus, and pelvic walls.

Figure 12 shows the uterosacral ligaments coursing from the cervix in a curved line posteriorly around to the rectum. Below and between the ligaments and in front of the rectum lies Douglas's culdesac. Note especially the location of the ureters usually easily found with a little close attention to their contractions and by picking them up between thumb and forefinger.

Great Vascular Trunks of Lower Abdomen and Pelvis.—In Figure 13, the aorta lies on the left, bifurcating in front of the last lumbar vertebra into the right and left common iliac arteries, the right iliac lying upon the common iliac vein and concealing it while the left lies above and to the outer side of the vein.

The ureters descend from the kidneys into the pelvis with their superior extremities and pelves concealed by the renal vessels. Above, they also lie behind the ovarian vessels which continue below on the outside as they drop over the brim into the pelvis from 2.5 to 3 centimeters from the sacral promontory. The nutrient vessels accompanying the ureters are always well seen and on the left there is a large tortuous vein. The right ovarian artery springs from the aorta, while the left, in the dissection before us, arises from a supernumerary renal vessel.

Figure 14 shows the usual origin of the ovarian vessels. The ovarian vein on the right receives the inferior adrenal (rare) as it debouches into the vena cava at a more or less acute angle, while the left vein empties into the left renal at a right angle at a greater mechanical disadvantage. On the right side three veins are visible in the pelvis near the ovary, but as they ascend to the brim two unite and then shortly join the third, making but

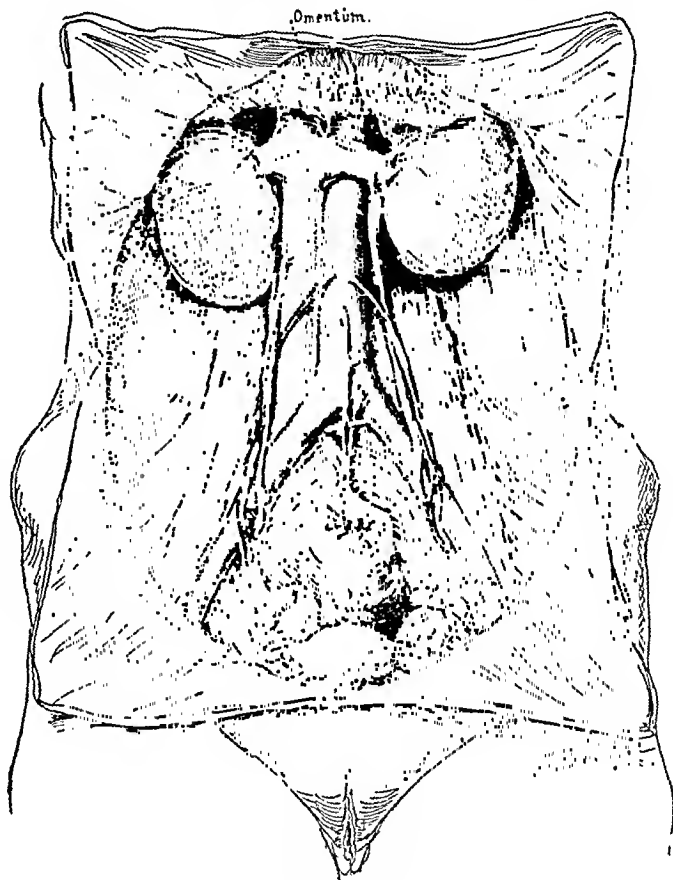


FIG. 14.—USUAL ORIGIN OF OVARIAN VESSELS.

one on the psoas muscle. The injection of the cadaver before dissection explains the venous distention.

Figure 15 is a bird's-eye view of the important vascular uterine trunks on the left with the uterus pulled up and to the right. The ureter passes beneath the uterine artery and one vein, while most of the veins lie under it.

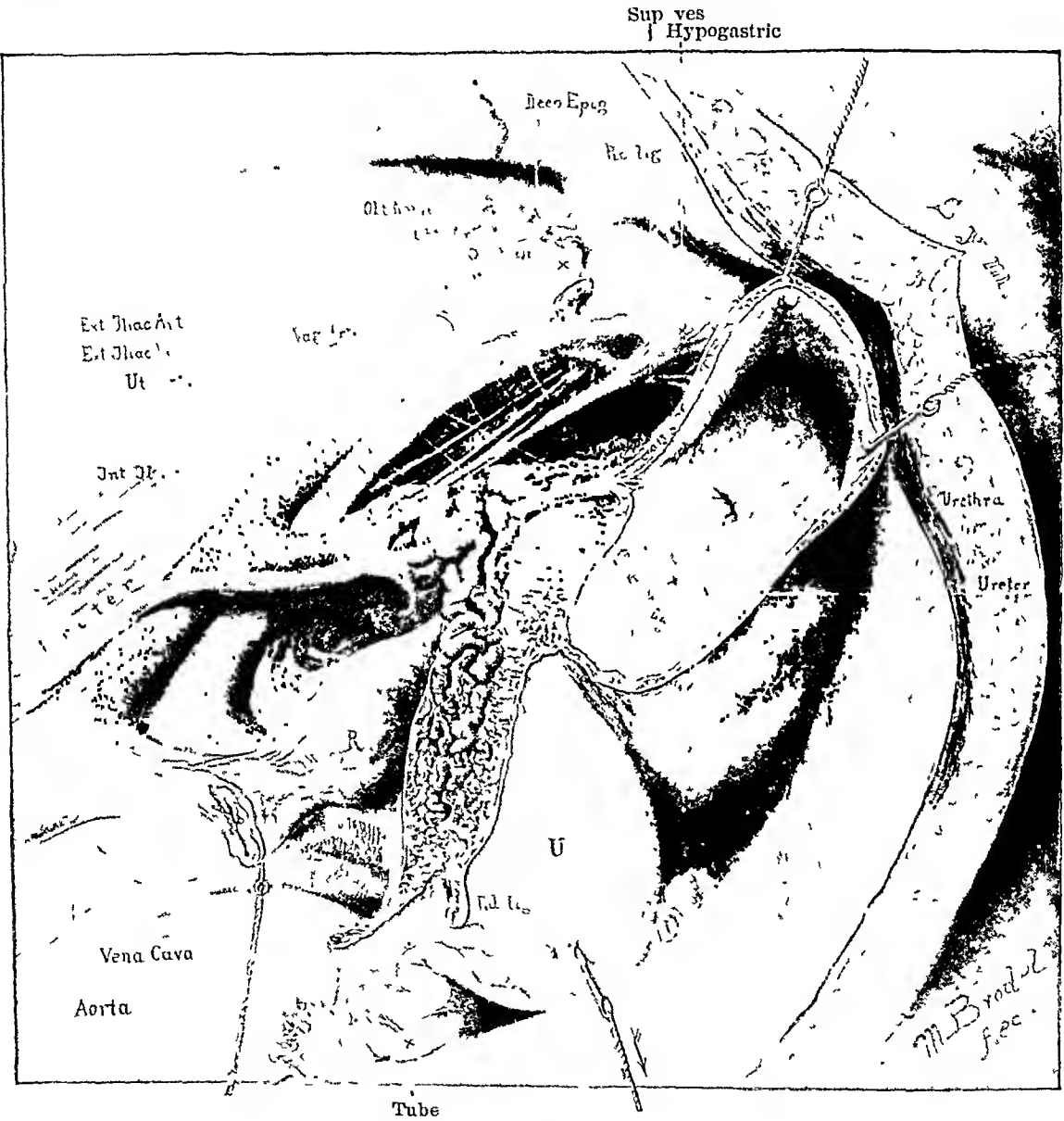


FIG. 15.—UTERINE VESSELS IN ORIGIN AND DISTRIBUTION, SHOWING ESPECIALLY RELATIONSHIP TO LEFT URETER.

The bladder is open, displaying the ureteral orifices; note also the position of the puckered closed internal urethral orifice. The arteries of the pelvis are exhibited from the bifurcation of the common iliac into its external and internal branches, with the division of the internal trunk into anterior and posterior. The uterine artery and the superior vesical arise from the anterior trunk terminating in the obliterated hypogastric. The vaginal artery here



FIG. 16.—UTERINE AND OVARIAN VESSELS; ANASTOMOSIS UNDER UTERINE CORNU.

arises from the hypogastric, instead of from the uterine. The ureter lies somewhat closer to the cervix uteri on the left.

Figure 16, an injected pelvis of a well-developed multipara, shows the vascular relations of uterus, ovary, and uterine tube from the front, the anterior lamella of the peritoneum being removed.

The relations of uterine vessels to the ureter, cervix, and vaginal vault should be noted, the ureter lying below the uterine artery and two of its veins (usually but one) and over a plexus of uterine and vaginal veins. The uterine artery ascends beside the uterus, 1, 2, or 3 millimeters distant, tortuous and

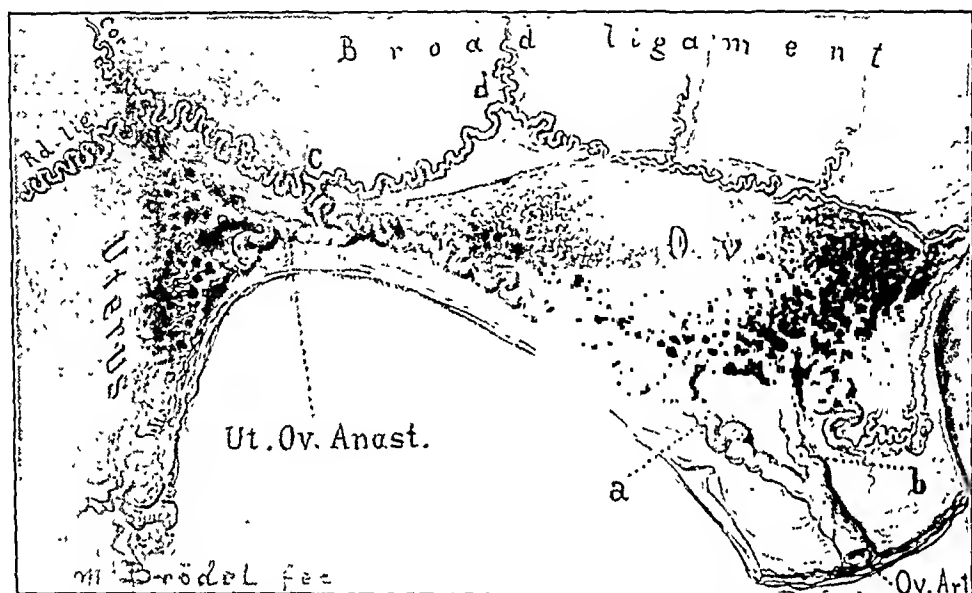


FIG. 17.—UTERO-OVARIAN ANASTOMOSIS SHOWN IN ABSENCE OF VEINS.

Horizontal vessel above gives off branches to uterine tube and round ligament.

interwoven with its veins. At the neck of the uterus, opposite the internal os, it gives off a larger artery which penetrates the uterine body; the other branches are smaller. Near the cornu uteri the terminal branch of the uterine artery anastomoses with the ovarian.

The ovarian artery, Figure 17, enters the pelvis in the suspensory (infundibulopelvic) ligament of the ovary to divide just before reaching the hilum of the ovary into two branches, *a* and *b*; the main branch *a*, continuing in its course toward the cornu uteri, sends numerous small vessels to the ovarian hilum and then penetrates the utero-ovarian ligament to pass to the side of the uterus and anastomose with the uterine artery. In the utero-ovarian ligament, it gives off a secondary branch *c* which pierces the ligament about 1 centimeter from the uterus to divide into two terminals coursing in opposite directions, one to supply the round ligament, while the other, *d*, runs along the base of the mesosalpinx parallel to the tube and anastomoses with the vessels of the first branch *b*. The horizontal vessel formed by this anastomosis gives off from four to six ascending straight branches, traversing the mesosalpinx to

the mesenteric attachment of the tube and running out under the tube to form a series of loop anastomoses.

Figure 18 is the parovarium of a girl of nineteen. The uterine tube is quite delicate; the ovary is visible behind the broad ligament which is viewed from the front. The attachment of the hilum of the ovary is indicated by the light shading. The delicacy of all the blood-vessels is striking. The parovarian tubules stand out clearly in the mesosalpinx about halfway between tube and ovary; the wolffian duct running parallel to the tube gives off some fifteen vertical tubules converging toward the ovarian hilum. Some of the outer tubules are convoluted. The outer extremity of the duct terminates in two so-called hydatids (hydatid of Morgagni), hanging free by delicate pedicles from the front of the broad ligament and falling across the tubo-ovarian fimbria.

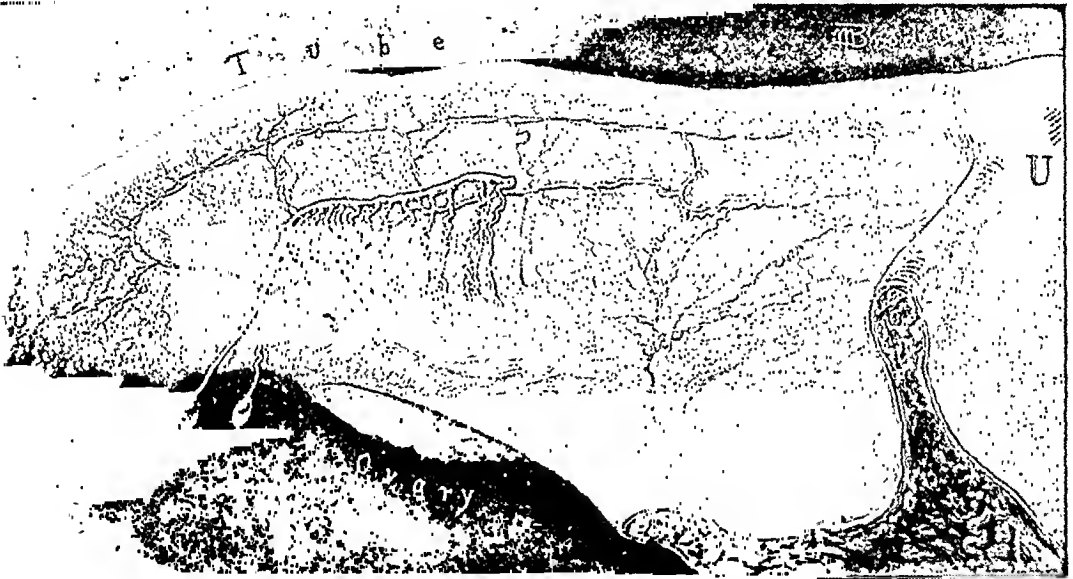


FIG. 18.—PAROVARIIUM IN GIRL OF NINETEEN.

Ovary, which lies behind mesosalpinx, seen hanging down below.

Intrinsic Blood Supply of Uterus.—J. A. Sampson in his communications on the blood supply of the uterus (*Surg., Gynec. & Obst.*, 1913, 5) and in subsequent contributions has furnished us with unexpected exact information regarding the ultimate distribution of the uterine blood-vessels derived from his injections of the uterine arteries and veins with gelatin containing pigment impermeable to the x-ray. Microscopic sections and stereoscopic radiographs of the material were then examined.

The course of the utero-ovarian anastomosis has long been noted. The uterine artery, as it runs parallel to the uterus, gives off at numerous levels a series of penetrating branches, each of which may divide into an anterior and posterior branch or without division may pass forward or backward into the myometrium. These intramural ("arcuate") arteries lie between the outer and middle thirds of the uterine wall, each supplying a quadrantal segment



FIG. 19.—RADIOGRAPH. ARTERIAL SUPPLY OF ENTIRE UTERUS.

Autopsy, nullipara, 25 years old, bismuth injection. (John A. Sampson.) $\times 1$.

making them adaptable to changes in the size of the uterus. The arteries of the myometrium have definite walls and become sclerotic with increasing age, and with pregnancy and delivery undergo temporary changes involving their thickening, involution, and destruction. Lesser arterial changes occur with each menstrual period, especially in the endometrial vessels. The lesser arterioles in the endometrium are more numerous just before menstruation when they extend to the compact layer and tissues just beneath the lining epithelium of the uterine cavity.

The arterial blood supply of fibromyomata is furnished by peripheral or radial branches of arcuate arteries. As a rule, but one artery supplies one such tumor; less frequently, there are two or even three peripheral or radial

of the uterus corresponding to an anterior or posterior half of a segment of the müllerian duct of that side.

The arcuate arteries terminate in median (peripheral) and radial (centripetal) branches, which in many instances anastomose with their fellows of the opposite side. One, longer than the others, the fundal branch, may be larger than the other arcuate arteries and appears as a terminal of the main uterine vessel. The radial vessels are the larger and, supplying the inner two-thirds of the myometrium, terminate in the endometrium. The median arteries are distributed to the outer third of the myometrium.

All the intrinsic uterine arteries pursue a spiral course,

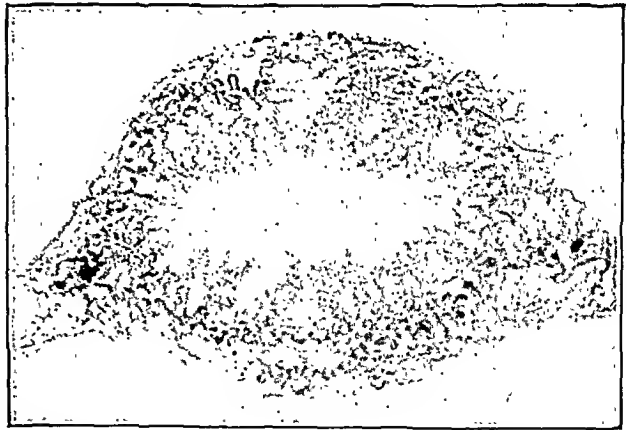


FIG. 20.—ARTERIAL SUPPLY OF SUBSEROUS MYOMA (M), 1.5 CENTIMETERS IN DIAMETER.

Radiograph of a cross slice of uterus, showing myoma. Patient, para, 40 years old, bismuth injection. (John A. Sampson.) $\times 1$.

vessels. The venous system of the uterus consists in a rich endometrial plexus fed by terminal branches of the radial arteries. There is a similar but larger plexus in the myometrium connected with the endometrial system by a series of veins. Collecting veins, sometimes accompanying the arcuate arteries, convey the blood from the myometrial plexus to the uterine veins.

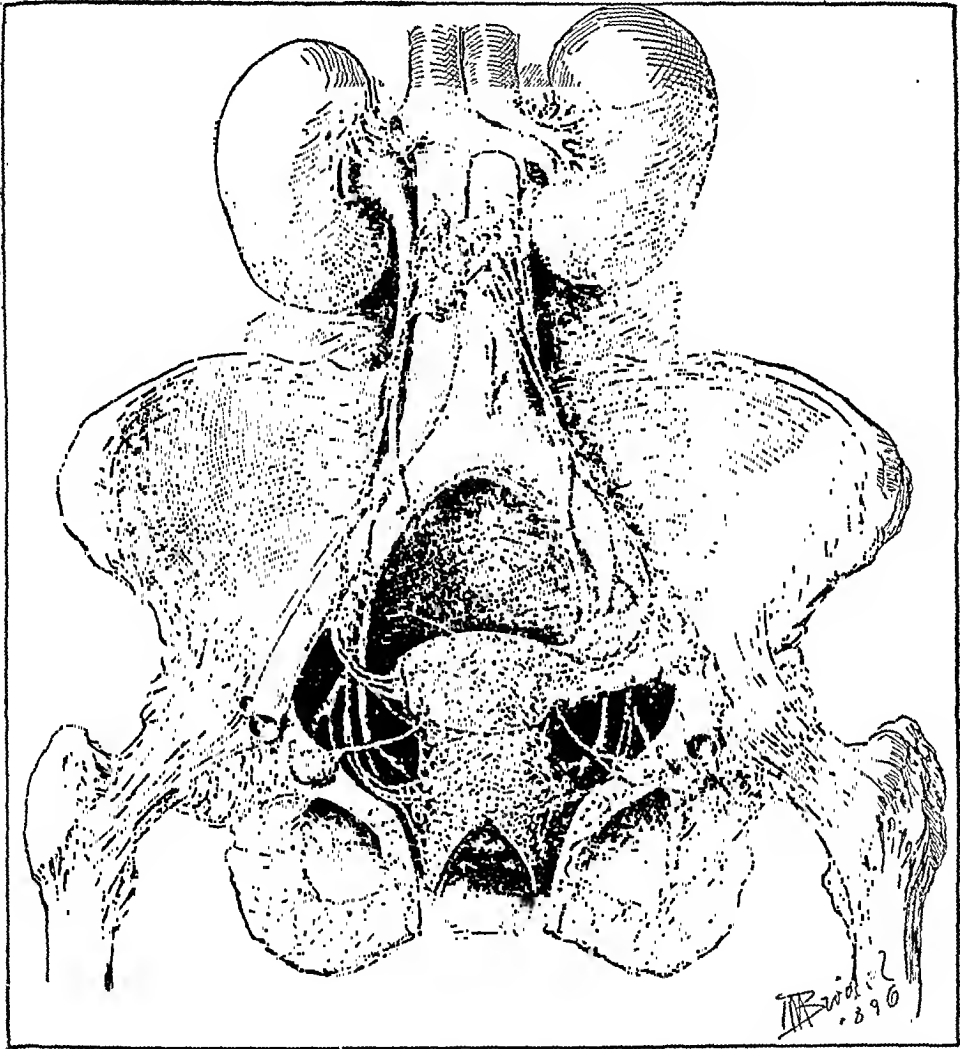


FIG. 21.—LYMPHATIC SYSTEM OF PELVIS AND ITS COMMUNICATIONS WITH PELVIC AND ABDOMINAL LYMPHATICS, AND, THROUGH ROUND LIGAMENTS, WITH GLANDS UNDER CRURAL ARCH.

As a rule, the veins first described, with the exception of the collecting veins of the myometrium, lack distinct walls and are merely endothelium-lined spaces between the bands of muscle-fiber. There being no valves in the uterine veins, Sampson argues that the muscular efficiency of the uterus must largely control the circulation. The presence of a fibromyoma, for example, in certain situations, prevents the uniform constriction of a musculature necessary to compress the vessels and becomes a factor in the associated menorrhagia.

On injecting uteri from patients menstruating at the time of operation, Sampson found that the venous injection mass escaped in part into the uterine

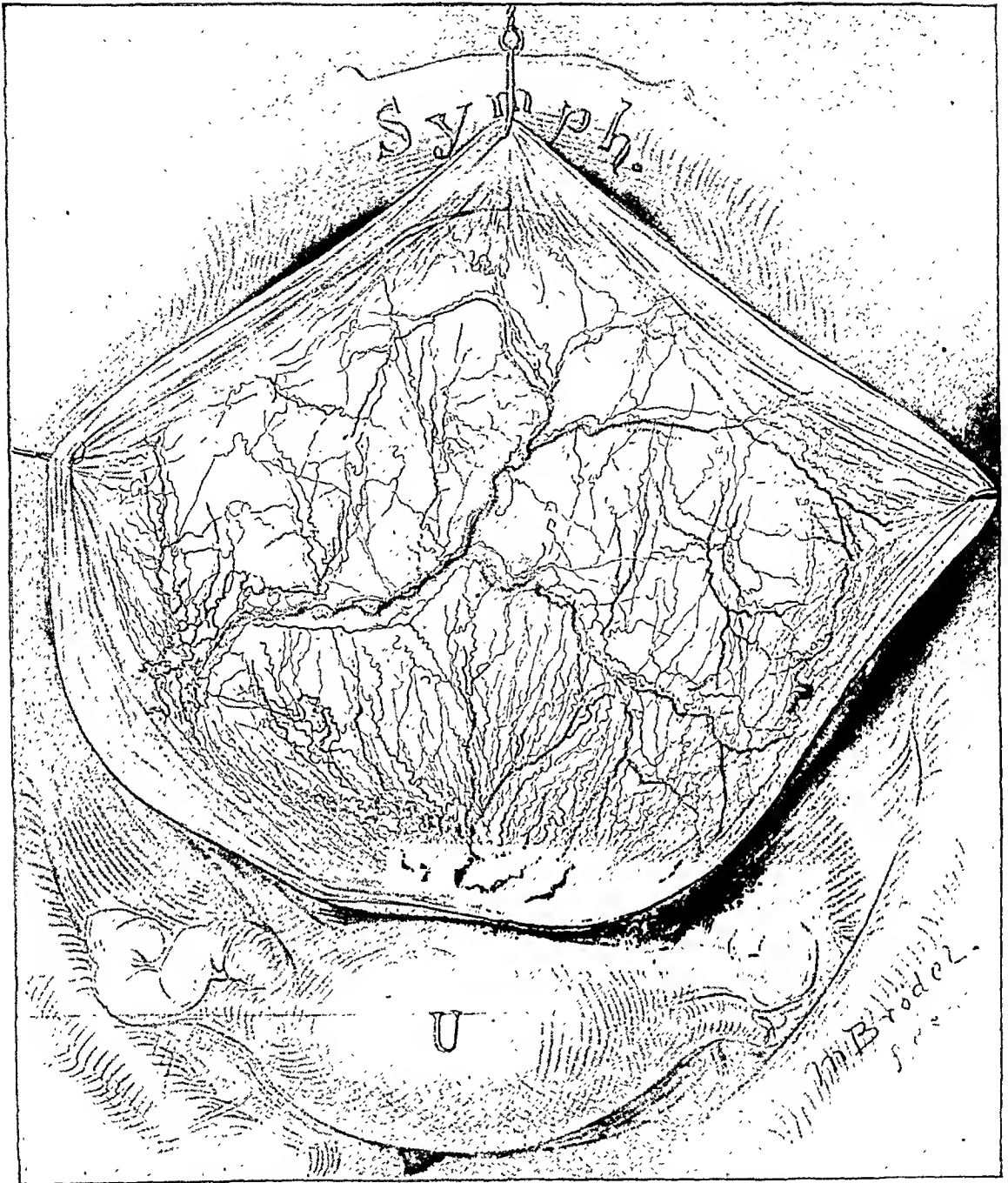


FIG. 22.—VASCULARIZATION OF VAULT OF BLADDER IN ITS PERITONEAL PORTION.

cavity, while that thrown into the arterial system was never lost in this way. Obviously, he concludes, menstrual blood is venous.

Lymphatic System.—The uterus with its appendages and the vagina are everywhere invested in a rich network of lymphatics, Figure 21, which have been admirably described by Mascagni and Poirier. A vascular network envelops uterus and vagina like fine lacework. Leaving the uterus, the smaller vessels collect into larger trunks and enter neighboring glands. From upper vagina and lower cervix lymph vessels collect to enter glands on the pelvic floor

and then to accompany the uterine and internal iliac vessels to the next system at the bifurcation of the common iliac arteries, *a a'*. From this point, the lymph channel leads over the artery to a gland often found on its upper side well above the bifurcation and so on up to the lumbar glands, *b b'*. The lymph vessels of the body of the uterus either pass out through the mesosalpinx near the ovarian attachment and on up the suspensory ligament of the ovary to the

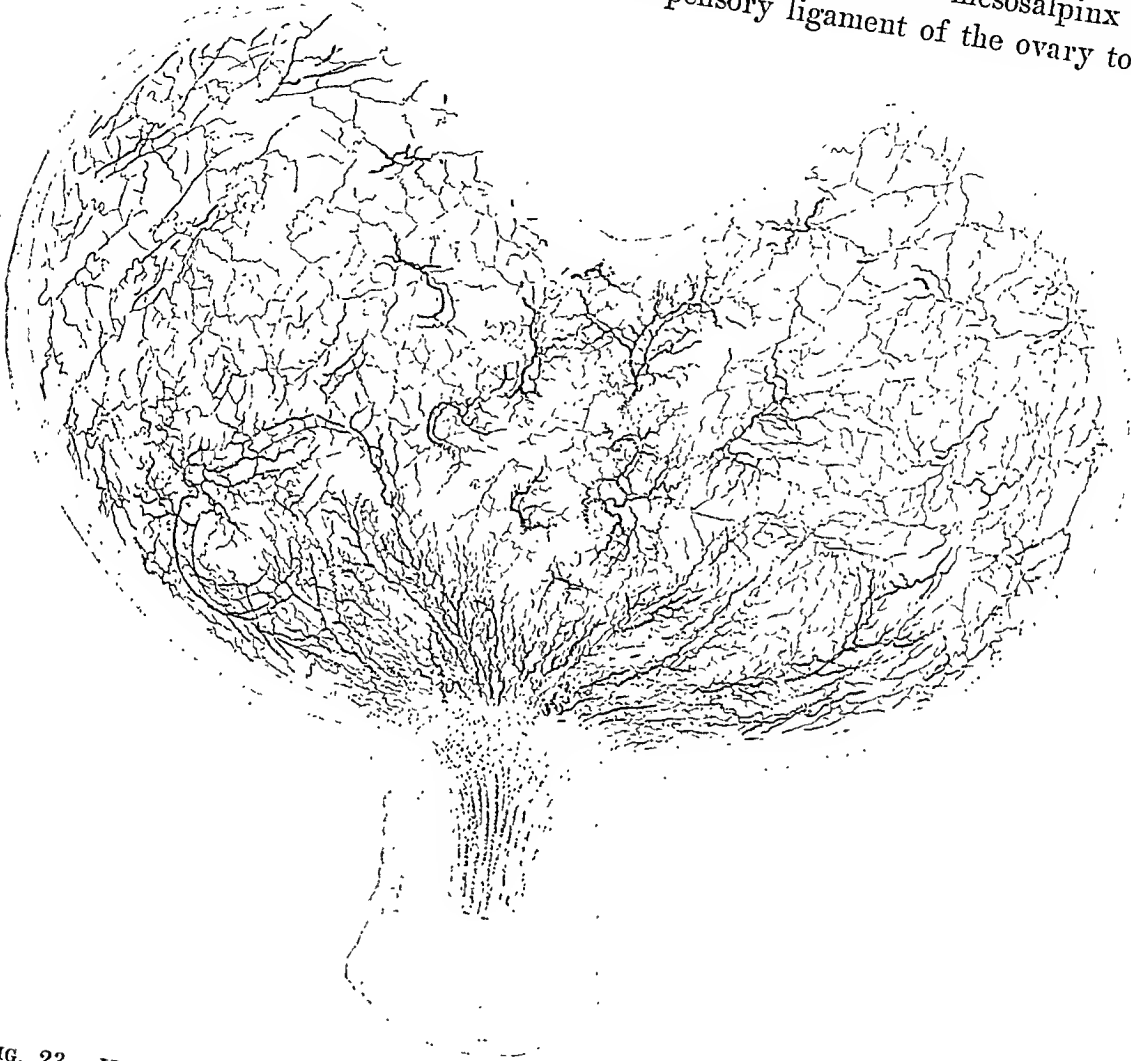


FIG. 23.—VASCULARIZATION OF VESICAL MUCOSA SEEN THROUGH CYSTOSCOPE.

lumbar glands or take quite another direction and course down the round ligaments to the deep inguinal glands, *c c'*. The lower vagina and external genitals are richly supplied with lymphatics which communicate with the superficial and deep inguinal glands and through these with those lying on the external iliac arteries.

Bladder.—Figure 22 shows the vascularization of the vault of the bladder; the peritoneum has been removed. The veins anastomose across from side to side and terminate below in the urethrovesical plexus at the neck of the

urethra. The superior vesical arteries course with the venous branches. It is important to note an unusual injection in the neighborhood of the cervix uteri.

Figures 23 and 24 exhibit the vascularization of the vesical mucosa and the dendritic arrangement of the little branches of the superior, middle, and inferior vesicals, after they emerge through the mucosa and branch out into smaller vessels and capillaries. Definite areas of the bladder are vascularized by the same groups, the first of which supplies the trigonal area, *c*, where they spread out fanlike into the bladder from the internal urethral to course toward the ureteral orifices and continue parallel to the ureterovesical folds until they reach the lateral walls of the bladder.

This group anastomoses with the next, *a*, derived from the superior vesicals to form the vascular trees appearing on the surface of the mucosa and distributed in fine branches. In the posterior bladder the middle vesicals supply the area in the neighborhood of the cervix uteri, *b*; fairly large vascular trees on the right and left are quite constant, forming characteristic landmarks as seen through the speculum.

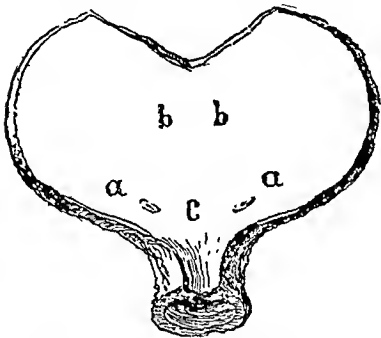


FIG. 24.—VASCULARIZATION OF VESICAL MUCOSA BY RIGHT AND LEFT SUPERIOR, MIDDLE, AND INFERIOR VESICAL ARTERIES.

Superior vesical arteries (*a*) distributed over superior and lateral regions of bladder. Middle vesical arteries (*b*) distributed over posterior portion, in relation to uterus and upper vagina. Inferior vesical arteries (*c*) distributed to trigonum and middle part of vagina.

forming a transverse fold with a sharp ridge above it and the point of convergence of numerous fine folds. The ureteral orifices lie about 2.5 centimeters apart and at a like distance from the urethra, each ureter being situated on a little mons ureteris. The posterior border of the trigonum is the interureteric ligament marked by a slight but well-defined elevation. Behind this the base of the bladder rests on the upper vagina. From the standpoint of the aërocystoscopist, the most fixed parts of the bladder appear to be well to the right and to the left in front of the broad ligaments which might be called the cornua.

Sagittal Section of Pelvis.—The rectum is drawn away from the sacrum, demonstrating arteries, veins, and nerves of sacral and lateral pelvic regions, Figure 26. The superior hemorrhoidal vessels are seen above. The sacral

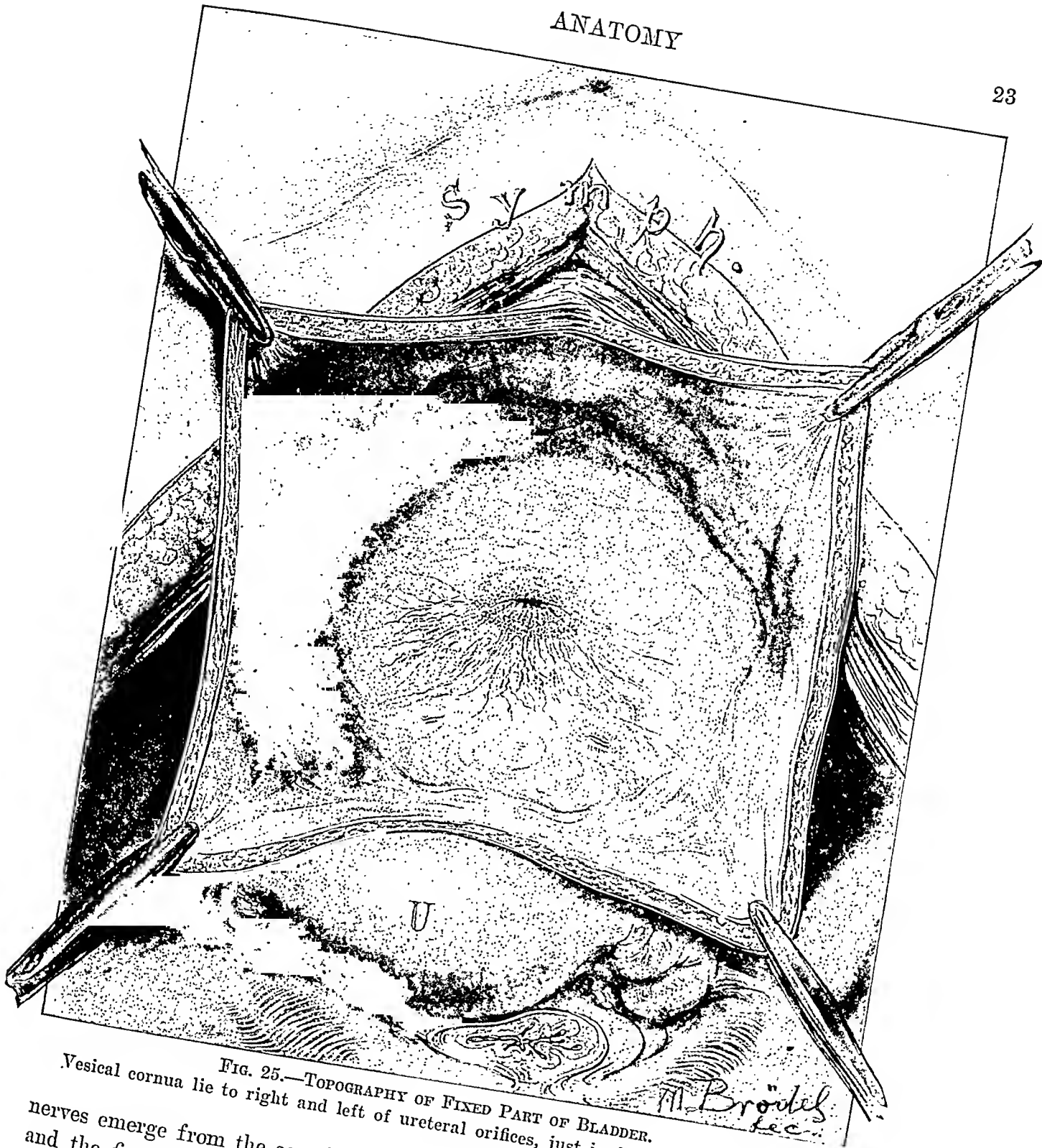


FIG. 25.—TOPOGRAPHY OF FIXED PART OF BLADDER.

Vesical cornua lie to right and left of ureteral orifices, just in front of broad ligaments. nerves emerge from the sacral foramina to form the lumbosacral cord (LSC) and the first, second, third, fourth, and fifth sacral nerves, which converge toward the great sacrosacral foramen, to unite, forming the sciatic nerve. The sacral ganglia of the sympathetic nerve are seen resting upon these nerve roots close to their foramina. Observe the nerves of the fourth sacral cord distributed also to the lower part of the rectum and to the coccygeus muscle.



FIG. 26.—SAGITTAL SECTION OF PELVIS WITH RECTUM DRAWN FORWARD DEMONSTRATING ARTERIES, VEINS, AND NERVES OF LATERAL PELVIC REGIONS.

Figure 27 shows the muscles of the pelvic wall in sagittal section with arteries and nerves. The psoas overhangs the pelvic brim, narrowing its superior strait; upon it lie the common and external iliac arteries, while it is crossed by the internal iliac artery. The obturator muscle covers the obturator foramen, its fibers converging to a tendon passing out of the pelvis through the lesser sciatic notch. At the lower margin of the obturator is the white fascial

line forming the upper border of the levator ani muscle, which is described later (See Figures 32 to 35). The coccygeus muscle bordering the posterior margin of the levator ani is fan-shaped and attached by its base to the side of the lower sacrum and coccyx and by its apex to the ischial spine. The piriformis muscle, Figures 28 and 35, pads the posterior pelvis, rising in muscular bundles from the front of the sacrum, and, gradually converging, passes out of the pelvis through the great sacrosciatic foramen behind the sciatic nerve.

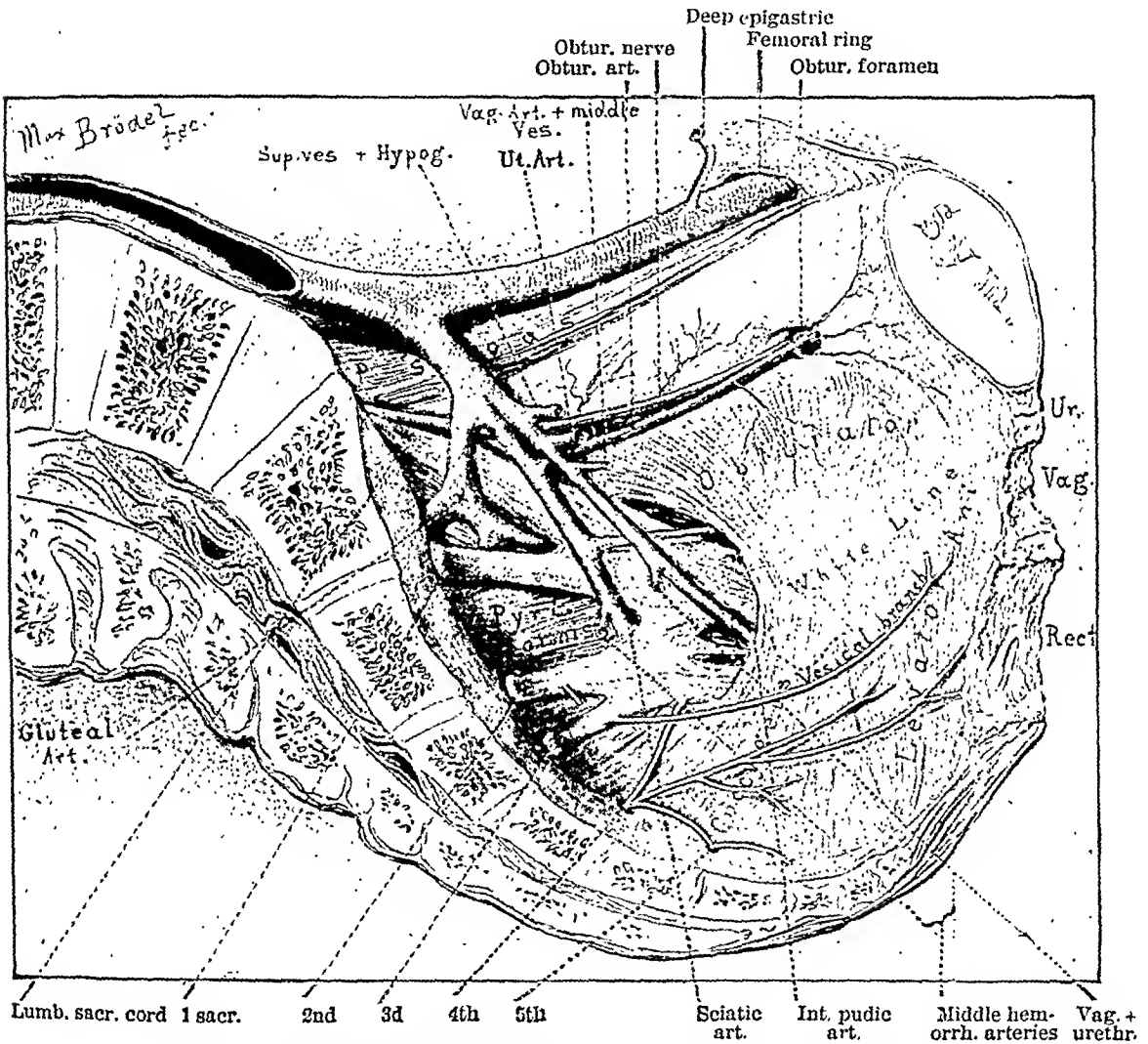
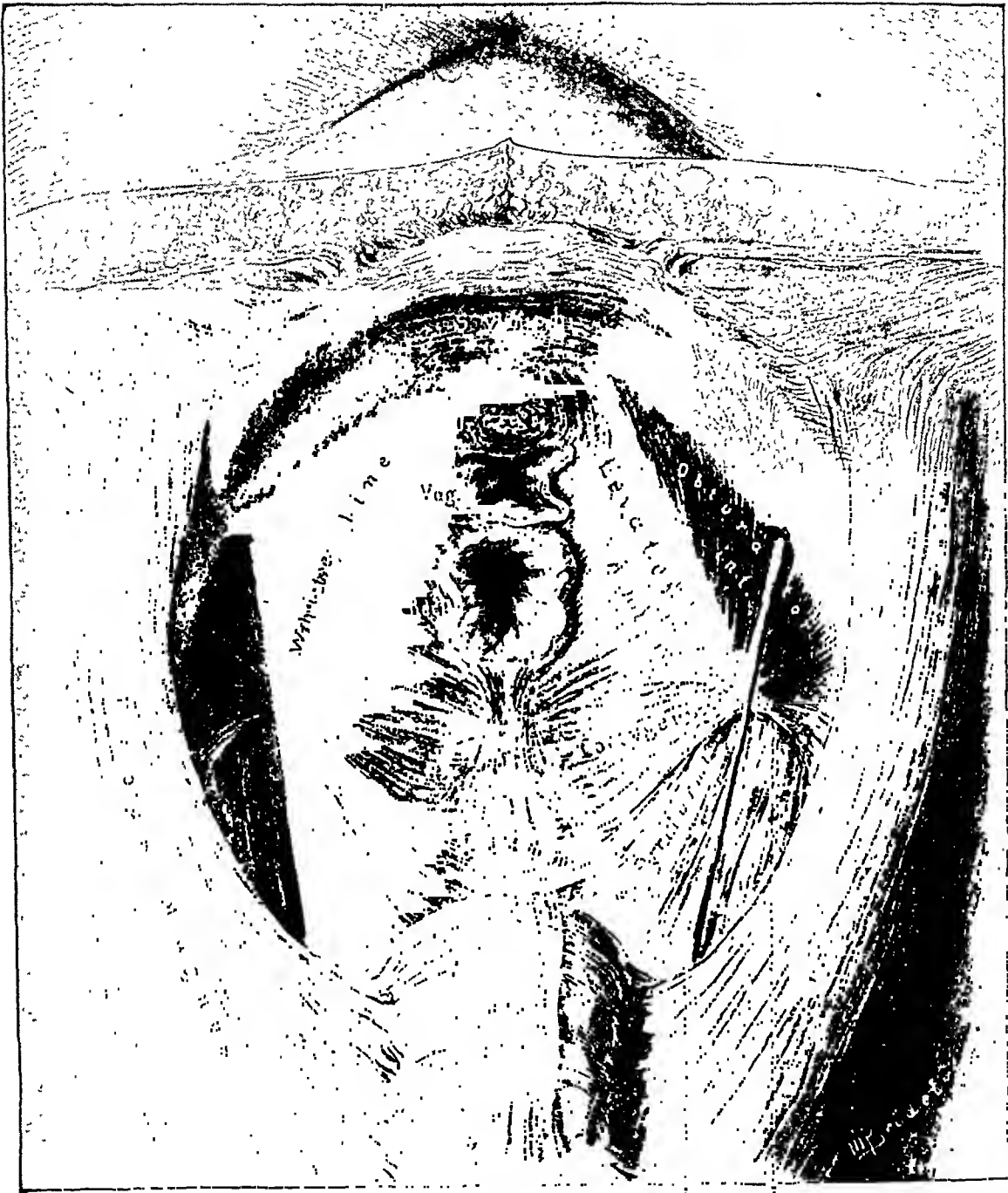


FIG. 27.—SACRAL NERVES—LOWER ROOTS PALPABLE BY RECTUM.

The obturator nerve courses around the wall parallel to and below the pelvic brim to the obturator foramen. The vesical branch from the third sacral cord is shown, as well as the nerves from the fourth to the rectum, levator ani, and coccygeus.

In Figure 29, the internal inguinal and femoral rings and the round ligament are viewed from within. Poupart's ligament divides the inguinal ring above from the femoral below. The external iliac artery and vein pass



Border of great sciatic foramen

Obturator nerve

FIG. 28.—MUSCULAR STRUCTURES FORMING FLOOR AND LATERAL WALLS OF PELVIS.

out of the pelvis under Poupart's ligament, giving off the deep epigastric vessels which course up under the abdominal wall around the mesial border of the internal inguinal ring and run in an oblique direction to the outer border of the rectus muscle which it follows beneath the transversalis fascia for about 5 centimeters when it pierces the rectus to lie well inside the semilunar line. Hesselbach's triangle lies between Poupart's ligament, the outer border of the

rectus, and the epigastric vessels. The round ligament crosses and lies upon these important vessels in its terminal abdominal portion.

Pelvis through Superior Strait.—Figure 42 shows the pelvic floor from within, viscera removed. Observe the relations of the orifices of exit—urethra, vagina, and rectum—in the muscular diaphragm of the pelvic floor,

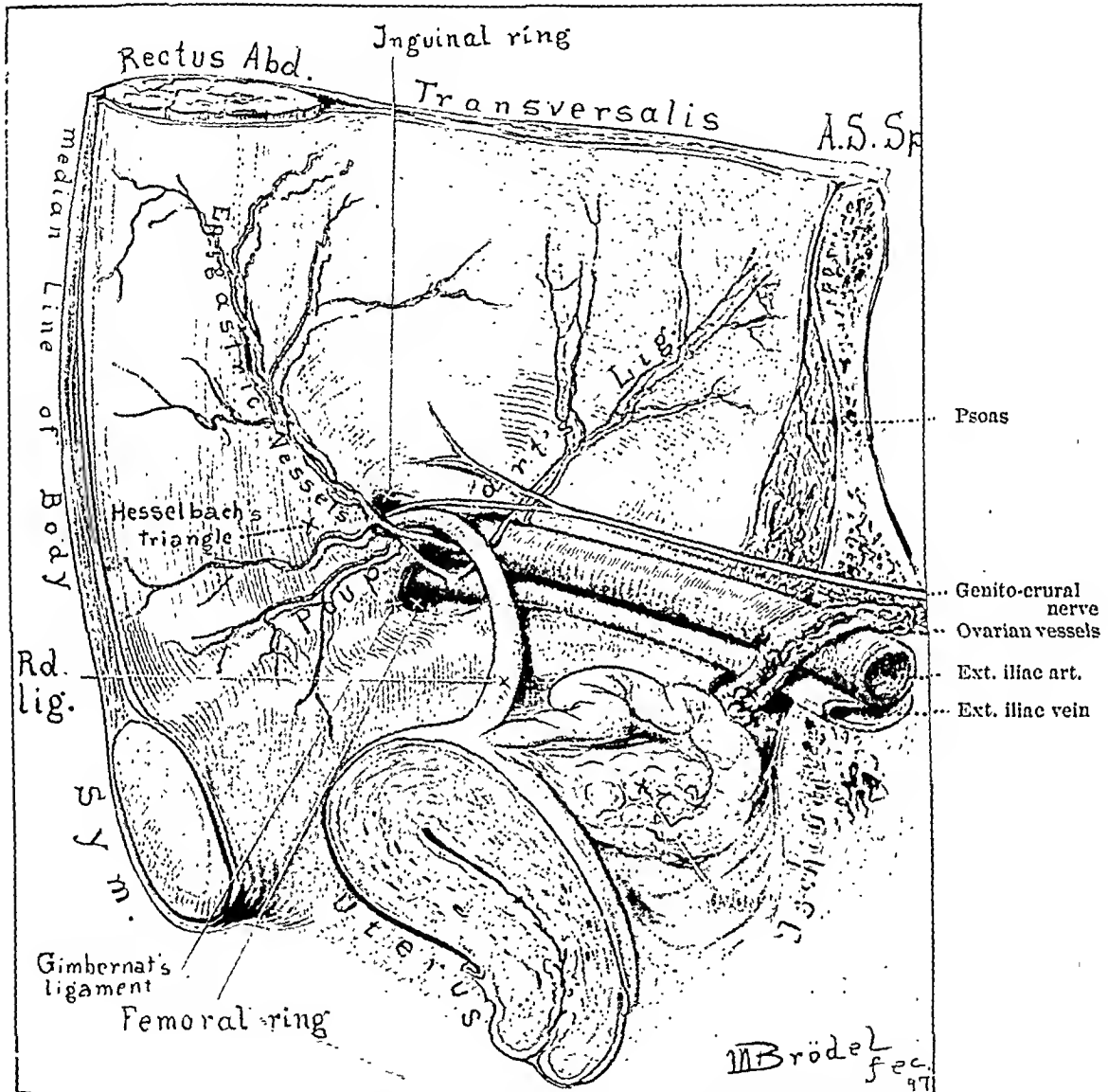


FIG. 29.—INTERNAL INGUINAL AND FEMORAL RINGS.

Round ligament seen passing out of inguinal canal.

and the relation of these to their surrounding muscular and bony supports. The pelvis is a funnel with its orifices located in the anterior portion; the urethra appears as a small slit invested with thick muscular walls just under the pubic arch. The vagina has the characteristic shape of a capital H lying on its side and is embraced by the muscular fibers of the levator ani which also haul the lower part of the rectum forward. The puckered rectal opening

is grasped in a sling of muscular fibers from the anterior portion of the levator ani and is attached posteriorly to the coccyx by a fibrous band. The levatores ani arise from the inner surfaces of the pubic rami and the slightly curved white line which crosses the obturator internus to end at the spine of the ischium behind. From this line or origin the levator fibers converge to form a muscular sling, attached to and embracing the lower end of the rectum, so directed as to pull the rectum upward and forward. The anterior thick bundles of fibers, arising from the upper inner part of the pubic rami, serve to draw the lower part of the bowel well forward and so act indirectly in closing the vagina. The

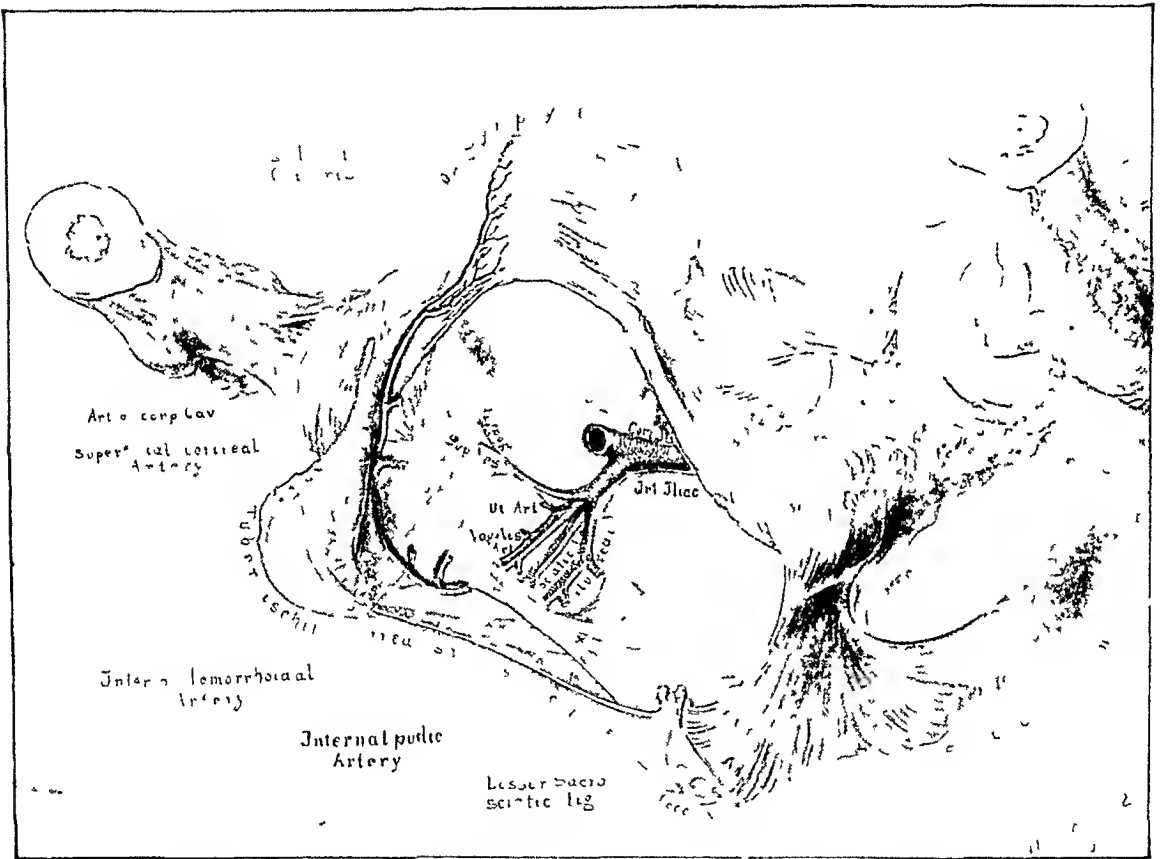


FIG. 30.—COURSE AND DISTRIBUTION OF INTERNAL PUDIC ARTERIES.

action of the posterior fibers is that of holding the bowel up. The coccygeus, pyriformis, and psoas muscles also appear as described in Figure 27.

Pelvis from Below.—As shown in Figure 30, the internal pudic artery arises from the anterior branch of the internal iliac, passes out of the pelvis through the great sacrospinous foramen, and crosses the spine of the ischium to reënter the pelvis through the lesser sacral foramen. From this point it curves forward, giving off various branches as it courses over the inner surface of the tuberosity of the ischium and emerges from under the pubic arch about halfway between the symphysis and the tuberosity on to the outer surface of the descending pubic ramus; it terminates on the anterior symphysis

and the dorsum of the clitoris. The trunks of origin of the inferior hemorrhoidal, superficial perineal artery, artery of the bulb, and corpus cavernosum are shown.

Figure 31 shows the arterial vascularization of the floor of the pelvis from without. The arterial branches are the derivatives of the internal pudic shown in Figure 30.

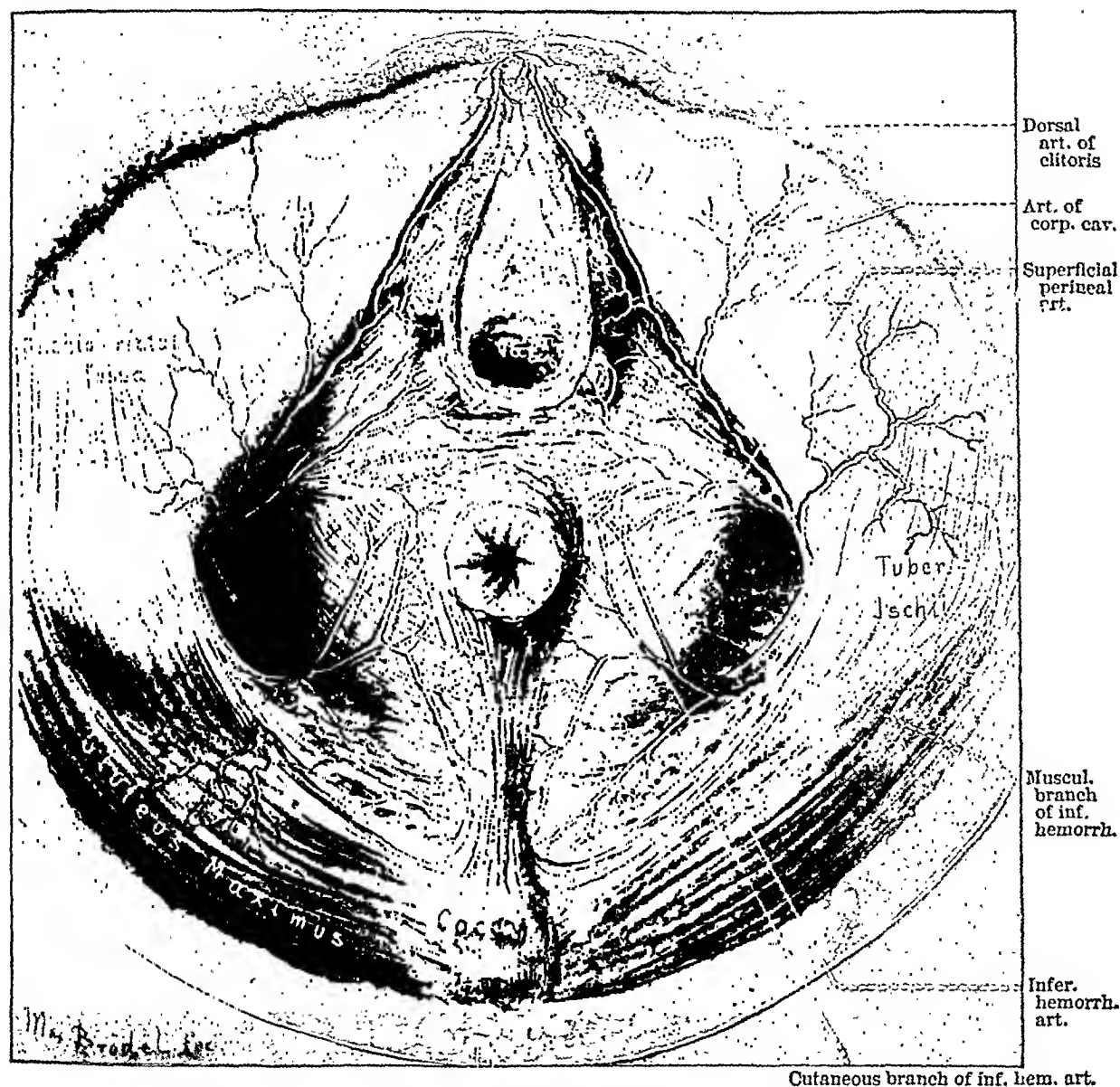


FIG. 31.—ARTERIAL VASCULARIZATION OF FLOOR OF PELVIS FROM WITHOUT.

Within the bony framework of the pelvic outlet, as completed laterally and posteriorly by the sacrospinous ligaments, are seen the three openings—urethral, vaginal, and anal—corresponding to those seen in the complementary picture, Figure 28. It is important again to note the position of the urethra, high up under the pubic arch, with the vagina immediately below and the anal orifice at about the center of the figure, halfway between pubic arch, coccyx, and

ischial tuberosities. A striking feature is the lateral position of the deep ischiorectal fossæ between the tuberosities and the levator ani muscles. Posteriorly the inferior hemorrhoidal arteries emerge from the ischiorectal fossæ, curving forward, to branch over the levators for final distribution to the lower rectum and the sphincter ani. The superficial perineal arteries emerge

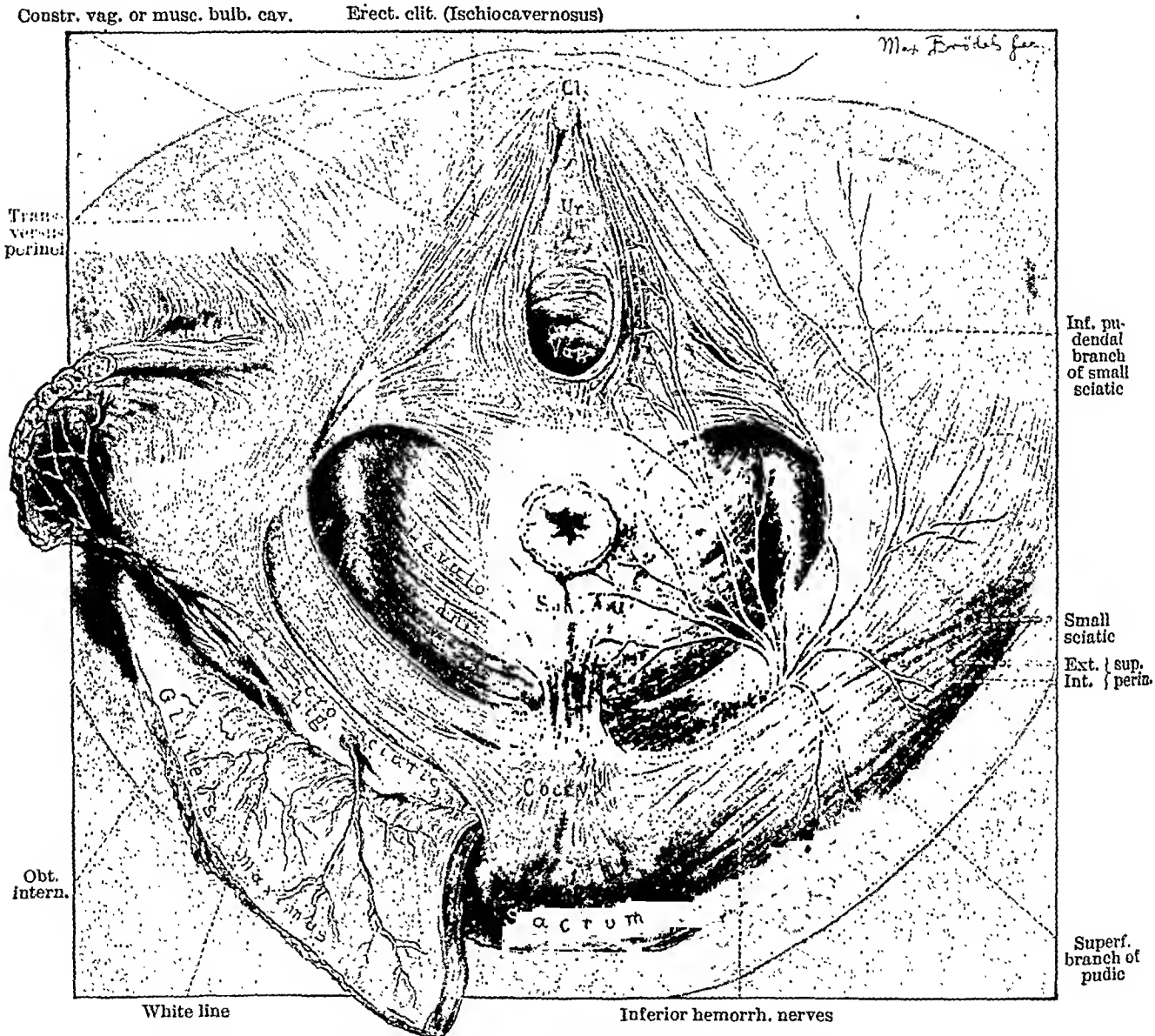


FIG. 32.—MUSCLES OF PELVIC FLOOR IN RELATION TO RECTAL AND VAGINAL OPENINGS.
On left, distribution of terminal branches of nerves.

from the ischiorectal fossæ anteriorly and course forward in front of the rectum over the transverse perineal muscles. The branches of the internal pudic artery are evident in their final distribution; a small branch goes to Bartholin's gland, a branch above this to the bulb of the clitoris, and the remaining branches to the corpora cavernosa and the dorsum of the clitoris.

The muscles of the pelvic floor in relation to the vaginal and terminal

branches of the nerves are shown in Figure 32. Posterior to a line crossing the anterior margins of the ischial tuberosities lie the following muscles. The transverse perineal takes its origin beneath the ischial tuberosity to cross the perineum horizontally between the vaginal outlet and the anal orifices and fuse with its fellow. A number of the muscular bundles diverge from the horizontal fibers anteriorly and posteriorly at angles of about 30 degrees to emerge in front with the constrictor vaginae and behind with the sphincter ani and the levators. The most conspicuous feature in the center of the figure is the roll of

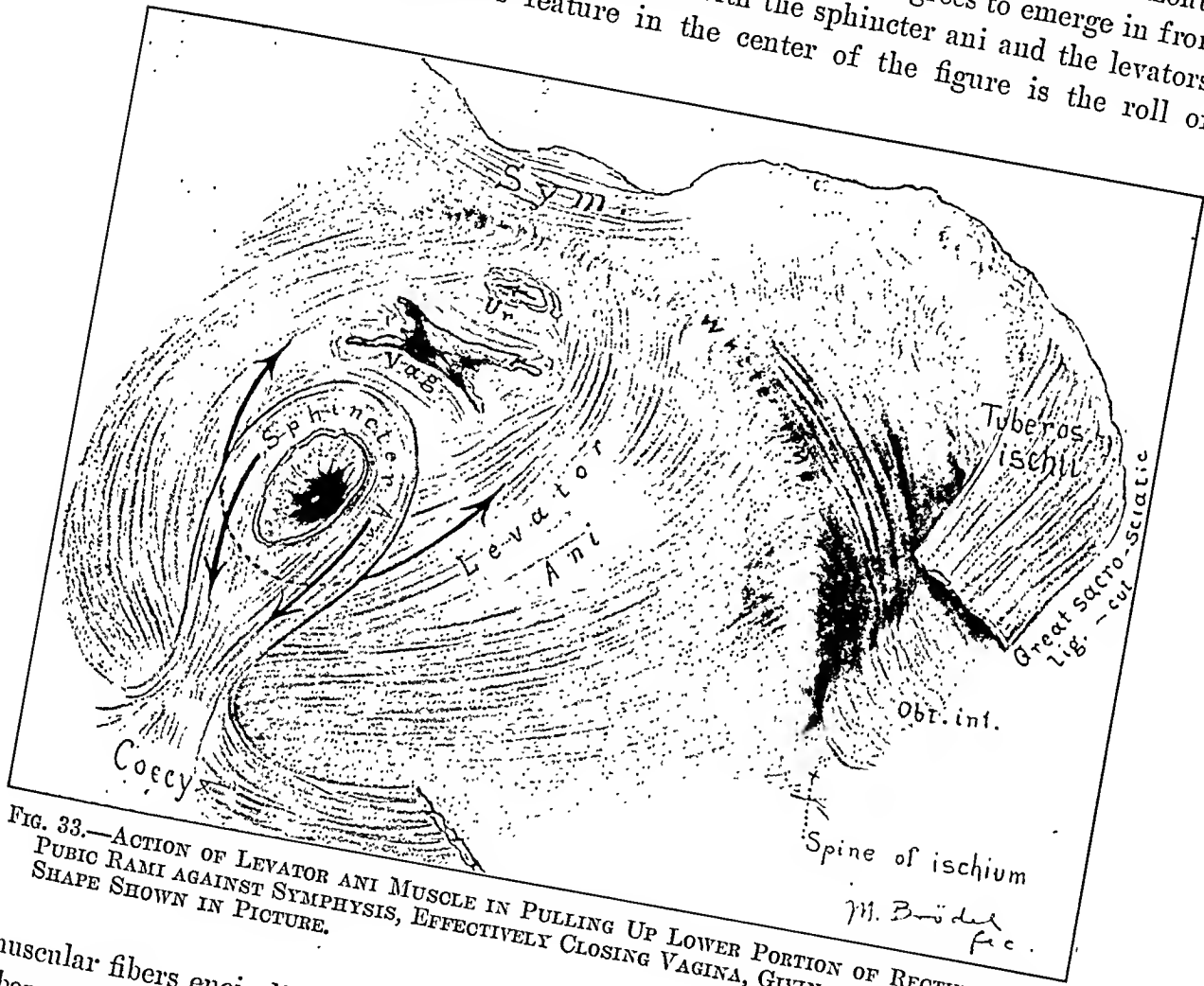


FIG. 33.—ACTION OF LEVATOR ANI MUSCLE IN PULLING UP LOWER PORTION OF RECTUM UNDER PUBIC RAMI AGAINST SYMPHYSIS, EFFECTIVELY CLOSING VAGINA, GIVING IT CHARACTERISTIC SHAPE SHOWN IN PICTURE.

muscular fibers encircling the anal orifice to form the external sphincter; these fibers posteriorly are attached to the coccyx.

The levator muscles on each side fill the spaces between the sphincter ani and the ischial tuberosities, each levator arising high up under the internal surface of the descending pubic ramus. The anterior portions cannot be seen in this drawing, but a part of the white fibrous line is visible. The coccygeus muscle, appearing almost as a continuation of the levator ani posteriorly, fills the space between the levator and the great sacrosciatic ligaments. In the anterior half of the picture, in front of the transverse perineal muscles, is shown the constrictor vaginae or bulbocavernosus embracing the vaginal outlet. Ex-

ternal to the constrictor lie the erectors of the clitoris, arising from the pubic arch posteriorly and converging toward the dorsum of the clitoris. On the right are the internal pudic and the inferior pudendal nerves. The various branches of the internal pudic nerve, similar in name and distribution to the corresponding arteries, Figure 31, are distributed to the muscles of the pelvic floor, perineum, and vaginal outlet.

The origin and insertion of the levator muscles are seen from below in Figure 33. The external sphincter ani, the lower part of the vagina, and the

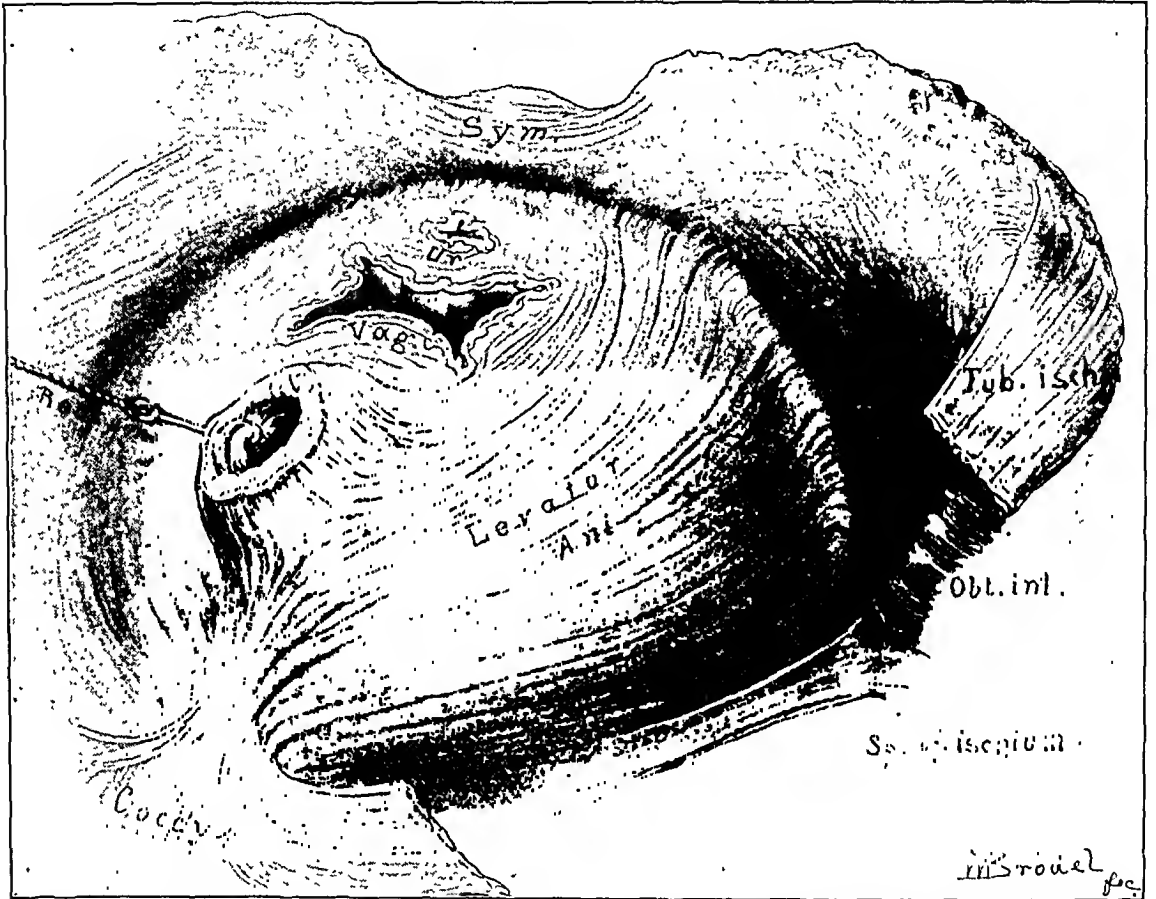


FIG. 34.—INTERLACEMENT OF ANTERIOR FIBERS OF LEVATOR ANI MUSCLE WITH INTERNAL SPHINCTER MUSCLE OF RECTUM.

extremity of the urethra have been cut off on a level with the levator attachments. Important landmarks are the symphysis, coccyx, and the left ischial tuberosity. The great sacrosacral ligament is removed to expose the levator muscle in its entirety. The whole line of origin of the levator is well shown. The direction of the fibers of this muscle change in the anterior and the posterior parts to such an extent that the fibers from the pubic arch form almost a right angle with the posterior portion.

Owing to the direction of the anterior fibers and their insertion into the fibrous tissues of the perineum and the sides of the rectum, they have a lifting

power upon these structures effectively closing the vaginal outlet. In Figure 34 note the blending of the levator muscle with the external longitudinal fibers of the rectum.

Coronal Section of Pelvis.—Figure 35 is a coronal section through the iliac crests, acetabula, and ischial tuberosities, showing the posterior pelvis and the levator muscles with the rectum in vertical section. The leaflike nature

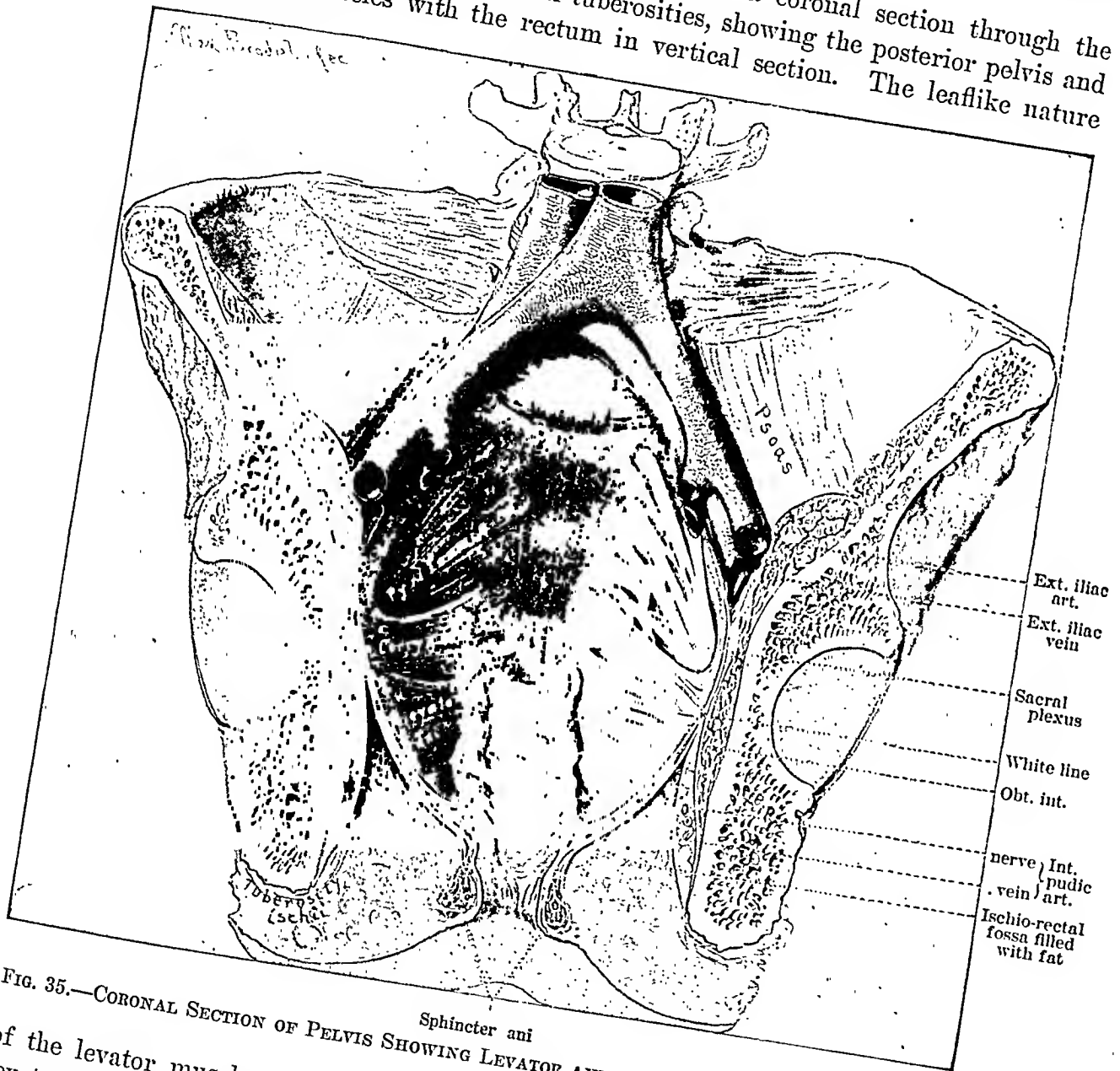


FIG. 35.—CORONAL SECTION OF PELVIS SHOWING LEVATOR ANI AND POSTERIOR PELVIC MUSCLES.

of the levator muscles is apparent. The half-funnel form of the posterior levators from the spine of the ischium to the coccyx is obvious. The broad surface of attachment is also shown where they blend with the longitudinal fibers of the rectum and with the internal sphincter ani. The division of the fascia ensheathing the obturator internus at the white line is apparent. The obturator internus appears in section between the levator ani and the ischium. In the depths of the ischio-rectal fossa, below the levators, appear the pudic

vessels and nerves close to the ischial tuberosities. The coccygeus and pyriformis muscles appear as continuations of the levator, paralleling its upper fibers and clothing the posterior pelvic walls on both sides of the sacrum. The sacral plexus overlies the pyriformis on the left.

Pelvic Fasciæ.—The strong supporting planes of pelvic fasciæ are considered in Chapter XVIII in their relations to the several plastic operations dependent upon their integrity for the support of the viscera.

CHAPTER II

HISTOLOGY

R. GLENN CRAIG

EXTERNAL GENITALIA

Mons veneris
Labia majora
Labia minora
Clitoris
Bartholin's Gland
Skene's Gland

INTERNAL GENITALIA

Hymen
Vagina
Uterus
 CERVIX
 BODY
 ENDOMETRIUM
 1. *Interval*
 2. *Premenstrual*
 3. *Menstrual*
 4. *Postmenstrual*
 5. *Pregnant*

Ligaments

BROAD
ROUND
UTEROSACRAL

Fallopian Tube

Ovary

CORTEX
MEDULLA
SECRECTIONS

The following chapter presents the anatomy of the individual structures with the immediate objective of the histology of each organ, in its turn serving as the norm of comparison for the pathology—a branch too much neglected until recent years by the gynecologists of this country, to the detriment of the scientific side of our work.

EXTERNAL GENITALIA

The mons veneris, labia majora, labia minora, clitoris, Bartholin's glands, and Skene's ducts are described under this head. The vagina is described with the internal genitalia.

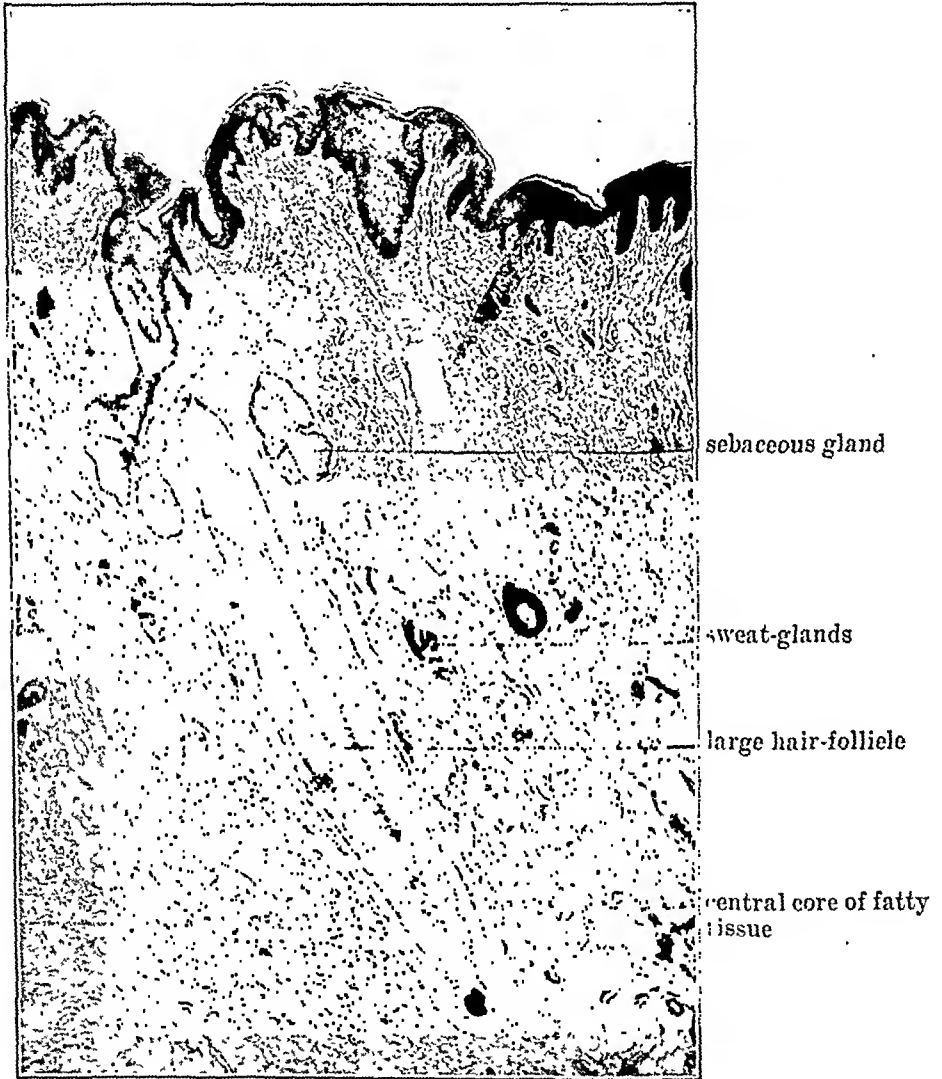


FIG. 36.—LABIUM MAJUS.

Labium majus, thicker and darker than normal skin, contains many large hair-follicles, sweat-glands, and sebaceous glands. Much fat from the central core of fatty tissue is seen. $\times 22$.

Mons veneris.—The mons differs from the skin only in that it is richer in hair-follicles and underlying fat.

Labia majora.—The labium majus, Figure 36, the homologue of the male scrotum, is the site of insertion of the outer ends of the round ligaments. The outer surface is thicker and of a darker hue than normal skin, and is especially rich in large hair-follicles, sweat-glands, and sebaceous glands. The inner surface is more delicate and thinner and contains only a few small hair-follicles.

A thin layer of involuntary muscle extends up from the dartos of the perineum beneath this outer covering and is known as the tunicadartolabialis. The subcutaneous fat covers a delicate fibro-elastic membrane which surrounds the central core of fatty tissue.

Labia minora (Nymphæ).—Figure 37 shows the delicate folds of skin which are covered by squamous epithelium continuous with the greater labium at the bottom of the interlabial groove on the external surface and with the vaginal mucosa on the internal surface, so that the inner surface assumes the color and appearance of a mucous membrane. Between the labia majora and the clitoris is an almond-shaped area, or remnant of the urogenital sinus, re-

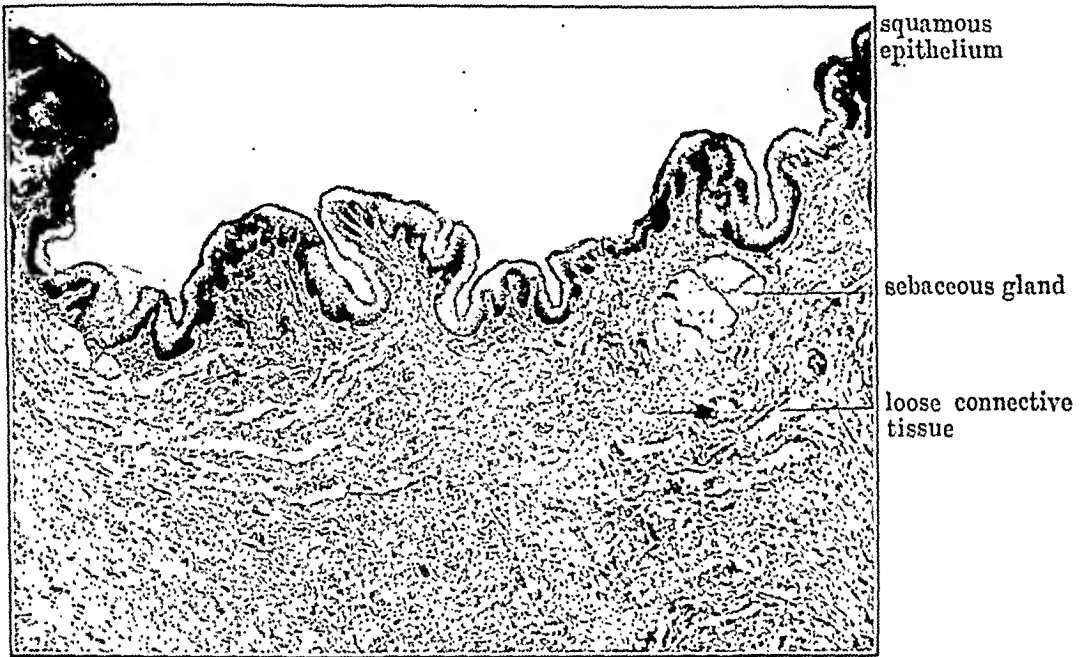


FIG. 37.—LABIUM MINUS.

Delicate tissue often thrown up into folds. Two sebaceous glands seen; no sweat-glands present. Loose connective tissue, immediately beneath the surface epithelium, is rich in unstriated muscle and blood-vessels and forms erectile tissue of labia minora. $\times 22$.

ferred to as the vestibule. The integument lies in immediate contact with the intermediate stratum of loose connective tissue which is rich in blood-vessels and bundles of unstriated muscle-fibers, forming the erectile tissue of the labium. Some sebaceous glands and sweat-glands are found, but no hair-follicles or fat are present. Figure 37 shows its marked tendency to be thrown into folds.

Clitoris.—The clitoris, the homologue of the male penis, is made up of two miniature corpora cavernosa and an imperfect or cleft corpus spongiosum covered by squamous epithelium. The venous lacunæ of the cavernosa are surrounded by fibrous trabeculæ containing numerous strands of smooth muscle irregularly disposed. This tissue becomes erectile in sexual excitement. Remnants of the spongiosum are often absent.

Bartholin's Gland.—Situated in the lower half of each labium on each side of the vaginal orifice is a small gland measuring 1 to 1.5 centimeters in length,

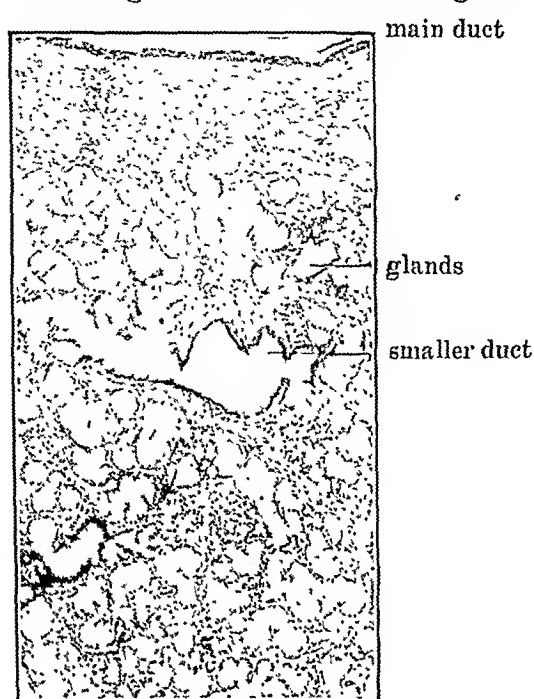


FIG. 38.—BARTHOLIN'S GLAND.

Transitional epithelium lining the main duct seen above, smaller duct near center of picture with gland opening directly into it. Protoplasm of columnar cells of compound racemose glands contains much mucus and takes but little stain, causing them to show indifferently in this picture. $\times 40$.

Bartholin's gland, Figure 38, the homologue of the bulbo-urethral or Cowper's gland in the male. This is a compound, racemose, mucous gland lined with columnar epithelium containing many mucous-bearing cells. Between the small component lobules are considerable tracts of fibromuscular tissue. The main duct opens into the vestibule and is lined by squamous or transitional epithelium near its terminus, while deeper down this changes to a cuboidal or low columnar epithelium.¹ The gland secretes a white viscid secretion, especially during periods of sexual excitement. The secretion acts as a lubricant.

Skene's Duct or Gland.—Lying close to the lateral and posterior margin of the urethral orifice is a small orifice, the opening of Skene's duct, or the para-urethral duct,

Figures 39 and 40, the homologue of the prostatic tubules in the male. The duct is about 1 centimeter in length and lined by stratified epithelium. The short tubular glands opening into it are made up of columnar epithelium.

INTERNAL GENITALIA

The vagina, the uterus, the fallopian tubes, and the ovaries comprise the internal genitalia.

Hymen.—The hymen develops from a clump of cells at the lowermost portion of the vagina, and arises from the müllerian duct. This circular fold of tissue forms the entrance to the vagina, and the vascular connective tissue containing numerous elastic fibers with some nerve-endings is covered on each side by a layer of rather thin stratified epithelium. Incident to childbirth the hymen is torn in various spaces and the remnants are represented by nodules of fibrous tissue, the *carunculæ myrtiformes*.

Vagina.—The organ of copulation, Figure 41, is a flattened muscular tube, 2 to 3 millimeters thick, lined by stratified epithelium, regularly thrown

¹ For finer histological picture see Thomas S. Cullen's "Cysts of Bartholin's Gland," *J. Am. M. Ass.*, Jan. 21, 1905.



FIG. 39.—CROSS SECTION OF URETHRA WITH DUCTS OF SKENE'S GLANDS ON RIGHT AND LEFT.
 $\times 18$.



FIG. 40.—URETHRA IN CROSS SECTION WITH SKENE'S GLANDS ON BOTH SIDES AND BELOW.
 $\times 18$.

up into minute folds—the columnæ rugarum—and more pronounced in nulliparous women; these consist of a thickening of the tunica propria and the inner circular muscle-bundle.

The stratified epithelium has a well-marked basement-membrane lying in immediate contact with the tunica propria, into which numerous short, conical,

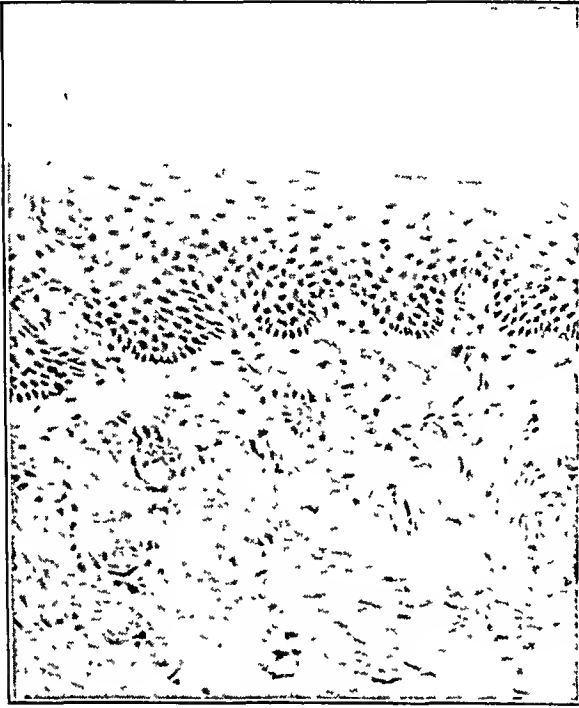


FIG. 41.—NORMAL VAGINA.

Stratified epithelium sharply outlined from underlying fibrous and elastic tissue. Short, conical, fibrous papillæ seen extending up into epithelium. No hornification present. $\times 110$.

fibrous papillæ extend. Hornification and pigmentation are not present except in pathological conditions where the mucosa is exposed to external irritation. Glands have been described but are rarely seen; they are lined by columnar epithelium when present.² The fibrous and elastic tissue of the tunica propria contains many veins and small lymphoid nodules and replaces the submucous layer. The muscular coat consists of two layers of unstriated muscular bundles, an inner circular and an outer longitudinal coat. The latter is best seen in the anterior part of the vagina where it forms the urethrovaginal septum. The tissue surrounding this is made up of connective tissue, elastic fibers, and many blood-vessels.

Normally, the contents of the vagina are acid, due to the action of

bacteria, especially Döderlein's bacillus, on the glycogen, which can be demonstrated in the vaginal mucosa, especially in the mid-interval stage.

In lower mammals (rat, mouse, guinea-pig, rabbit, dog, and even the opossum), the vaginal wall undergoes remarkable changes during the various phases of the estrous cycle, but so far, corresponding changes have not been definitely demonstrated to occur in man. From the work of Strive, it seems likely that in the premenstruum, the vaginal mucosa, like that of the uterus, is considerably thickened. It seems more certain that such a growth takes place as pregnancy

² Cullen, considering vaginal glands in 1904, said: "The existence of vaginal glands has been much questioned, but v. Preuschen, in 1877, after a careful examination of thirty-six bodies, found definite vaginal glands in four. The necks of these glands were lined by squamous epithelium, while the deeper portions, which spread out into definite bays, were lined by cylindrical epithelium on which cilia could be detected. Opening into the dilated glands were little crypts. Similar glands had previously been noted by Hennig in 1870." (Thomas S. Cullen, "Vaginal Cysts," *Trs. Am. Gynec. Soc.*, 1904.) Cullen, dealing with a small cyst 6 millimeters in diameter and lined by one layer of cuboidal epithelium, found a small oval gland space in the vagina lined by one layer of high cylindrical epithelium.

advances, and Strive has shown that the connective tissue, both white and elastic, undergoes thickening and curling with an increase of fluid in the interspaces, and the muscle-fibers increase in size as do those of the uterus, though to a lesser degree. All of the changes are manifestly in preparation for the act of parturition.

Uterus.—The organ of menstruation and gestation is a muscular structure partly covered by peritoneum and containing a cavity lined by a mucous membrane, or endometrium, in which the fertilized ovum develops and from which the resulting fetus is expelled at the completion of gestation by the contraction of its muscular walls. The nonpregnant uterus measures about 7 centimeters in length; the lower 2 to 3 centimeters, the portion below the internal os, constitutes the cervix uteri, and the remainder forms the corpus uteri. The convex upper extremity is known as the fundus.

Cervix.—The cervical canal forms the communication between the uterine cavity and the vagina. This is surrounded by a wall of nonstriated muscular bundles arranged with apparent regular irregularity and mixed with a large amount of fibro-elastic tissue. The presence of the large amount of this fibro-elastic tissue gives the characteristic hardness to the cervix, and is largely responsible for its distensibility. During pregnancy the cervix softens, due to the increase in connective tissue and lymph-spaces. "Hegar's sign" of pregnancy is based on this phenomenon.

The mucosa lining the cervical canal is entirely different from the epithelium covering the vaginal portion of the cervix which is continuous with the mucosa of the vagina.

The stratified epithelium of the vagina extends over the vaginal portion of the cervix to the external os, or through the lower third of the cervical canal. In multipara, or in pathological conditions, it is at a lower level. This stratified epithelium has a definite basement-membrane and a few short papillae of connective tissue extending up into the stratified epithelium, Figure 42. Occasionally, cervical glands open through this epithelial layer into the vagina.

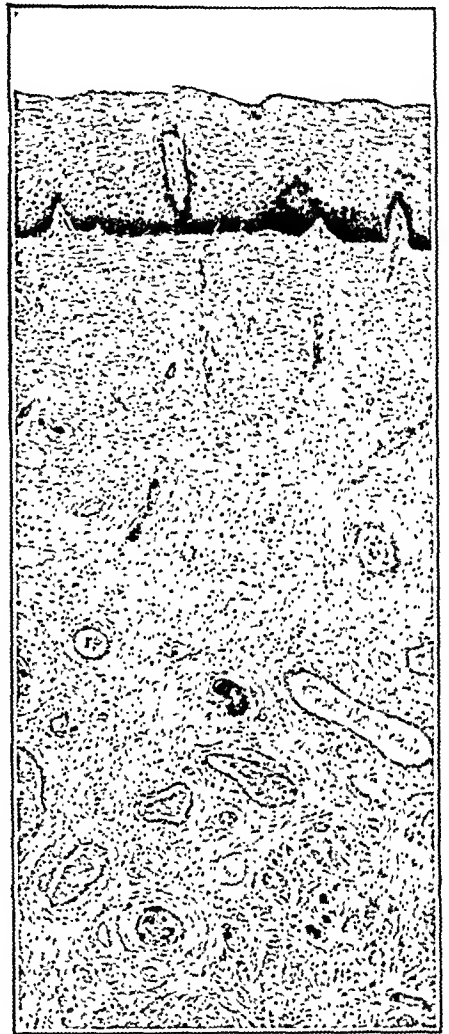


FIG. 42.—VAGINAL PORTION OF CERVIX.

Same type of epithelium covers the external portion of the cervix as lines vagina, and sometimes extends up into cervical canal. Some hornification seen and several short fibrous papillae projecting up into the epithelium. Blood-vessels and connective and muscular tissue of cervix seen beneath. $\times 62$.

Nabothian follicles are obstructed cystic cervical glands distended with accumulation of the gland secretion and are found in either portion of the cervix.



FIG. 43.—NORMAL CERVICAL GLAND.

A branching cervical gland projects down into fibrous tissue of cervix. Note tall, narrow cell with clear protoplasm and oval nucleus at base, the "picket-fence" epithelium of the cervix. Some cellular debris seen in lumen of gland. $\times 150$.

The mucosa of the cervical canal, Figure 43, begins by an abrupt transition from the stratified epithelium to a single layer of very high (40 to 50 μ) and relatively narrow columnar epithelium which Cullen refers to as a "picket-fence" epithelium of the cervix. The small deeply-staining irregular nuclei are situated at the base, and the protoplasm in the upper portion is clear, almost transparent, due to the absence of mucus. With a hematoxylin and eosin stain, a deep blue stain of the protoplasm indicates the presence of much mucus.

The glands of the cervix are lined by epithelium of the same character. They extend directly down and by numerous branchings into the underlying stroma. There is no submucosa. These glands furnish the thick tenacious secretion of the cervical canal, which is most marked just before menstruation or during pregnancy.

Body.—The portion of the uterus lying above the internal os constitutes the body of the uterus which contains the uterine cavity lined by epithelium. The musculature makes up the main portion of the body. The bundles of involuntary, unstriated, muscle-fibers run in all directions without any definite arrangement and are mixed with bundles of connective tissue and some elastic fibers. These bundles are well supplied with blood-vessels.

Endometrium.—Lining the uterine cavity, the endometrium undergoes a constant change in preparation for the nutrition of the possibly impregnated ovum. Failure of the impregnated ovum to become imbedded results in the

breaking down of the endometrium, or menstruation. In addition to the individual variation and the variation with age, there is a constant variation with the stage of menstruation, the thickness varying from 1 to 5 millimeters in the interval stage to 3 to 7 millimeters in the stage of premenstrual hypertrophy. In a child, the endometrium is thin, while the glands are shallow and almost absent. After the menopause, the glands again straighten and become smaller while the stroma becomes more dense.

1. *Interval*.—Usually described as the normal,³ Figures 44 and 45, this is the stage most often seen and sometimes spoken of as the “resting stage,” although there is a gradual increase in thickness and cellular activity from the early to the late interval stage. In the same individual, the thickness may increase threefold during this period. The epithelial lining, glands, and stroma are usually described.

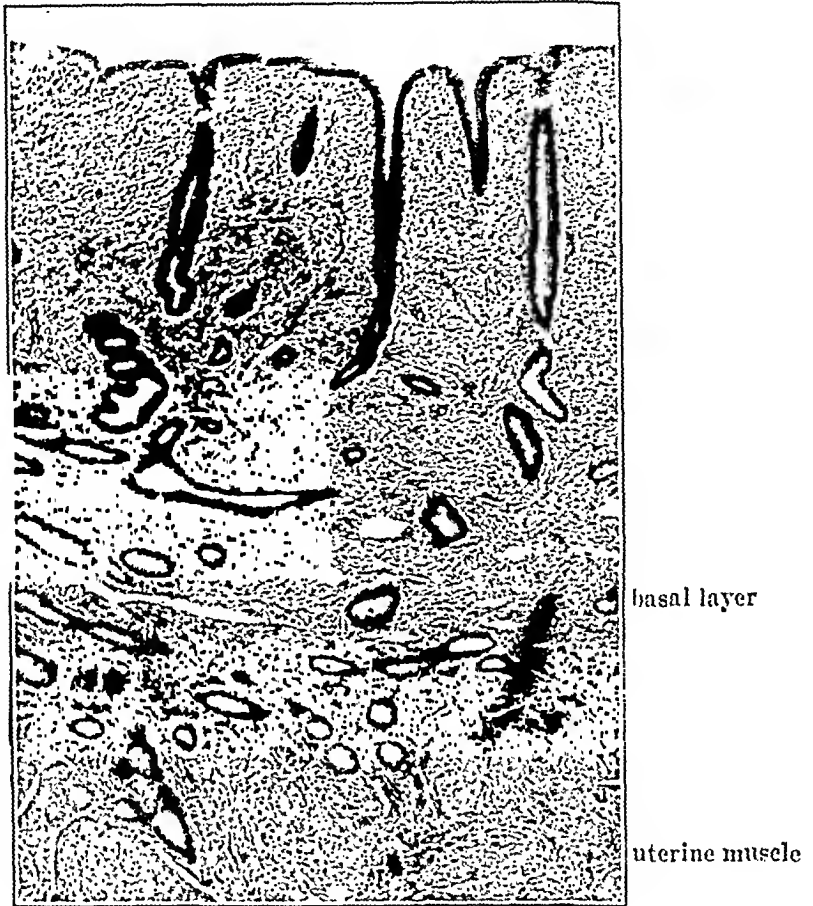


FIG. 44.—EARLY INTERVAL ENDOMETRIUM.

Glands cut in longitudinal and transverse section; stroma less compact; glands larger than in postmenstrual stage although there is little tortuosity here. $\times 44$.

The mucosa rests directly on the muscle layer. The irregular outline corresponds to the interstices between the various muscle-bundles and the endometrium frequently extends down for a short distance between the muscle-bundles.

The surface of the mucosa is lined by a single layer of epithelium. The individual cell is a relatively low (28μ) and broad columnar epithelium, the “board-fence epithelium” of the uterus, Figure 44, which is totally different from that of the cervix, or the “picket-fence” epithelium of the cervix. The oval vesicular nucleus is situated in the lower half of the cell. The protoplasm

³This is the stage which is usually seen and has been described as the normal formerly.

of the cell takes an eosin stain. The surface of the cell is ciliated. As this approaches the premenstrual stage, the epithelium becomes taller and larger, Figure 45.

The straight, tubular glands of the endometrium open directly into the uterine cavity and are lined by and are continuous with epithelium similar to the surface epithelium. Usually these project straight down into the endometrium with some dichotomous branching in the deeper portion. During the early interval period, the glands are quite straight but as menstruation approaches they become more tortuous until they gradually become the corkscrew glands of premenstrual hypertrophy. This increased activity causes the gradual thickening of the endometrium.



FIG. 45.—ENDOMETRIUM IN THE INTERVAL.

Between the glands a characteristic embryonic type of cell closely packed together forms the stroma. The nuclei are oval or spindle-shaped, while the protoplasm varies in its staining reaction. Scattered among the stroma cells, especially in its more superficial layers, are mononuclear cells, with a few focal collections of lymphoid cells, resembling lymphoid follicles. This stroma shows the characteristic reaction no matter whether found in or outside of the uterus, forming decidua cells during pregnancy.

Three distinct layers can be seen in the endometrium: the compacta, the spongiosum, and the basalis. The compact layer comprises the superficial, 30

to 35 per cent of the endometrium. In this layer the stroma is more abundant and only the necks of the glands are present. The decidua cells of pregnancy are formed chiefly in this layer. The basalis layer, forming 10 per cent of the endometrium, lies in immediate contact with the muscle-bundles and is more constant in its microscopic appearance during the different stages of menstruation. The glands are round and vary in size. The stroma is dense with a small amount of protoplasm with a relatively large nucleus. The spongy layer, forming 50 to 60 per cent of the endometrium, lies between

these two layers. The body of the glands lies chiefly in this layer surrounded by a small amount of loose intervening stroma. Variation in the thickness of the endometrium during the stages of menstruation occurs mainly in this layer.

2. *Premenstrual*.—Immediately preceding menstruation. Figure 46, the endometrium reaches its greatest growth, occasionally being 7 milli-

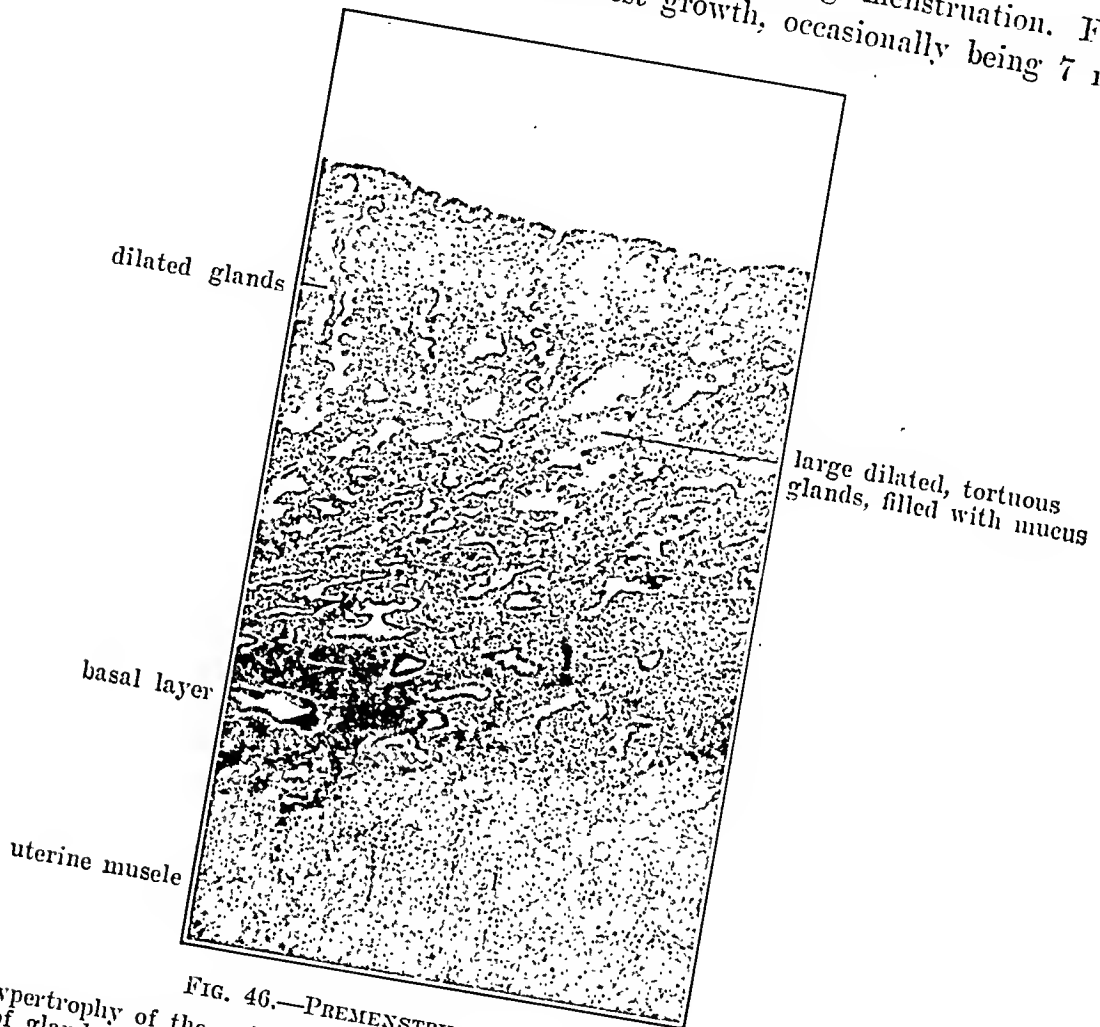


FIG. 46.—PREMENSTRUAL ENDOMETRIUM.

Great hypertrophy of the endometrium preceding menstruation due to increased size and tortuosity of glands which actively secrete mucus. Stroma loose and edematous. Immediately preceding menstruation, there is an outpouring of leukocytes into superficial layers. $\times 44$.

meters in thickness. The activity of the cells at this time is shown in the epithelium which is low, indistinctly outlined, and actively secreting mucus, causing the physiological premenstrual leukorrhea. The activity of the glands which are in the increased tortuosity and corkscrew arrangement of the glands which are filled with mucous secretion, causing the increase in the thickness of the endometrium. This corkscrew tortuosity of the glands frequently gives the appearance of papillary projections into the lumen. The cells of the stroma become large and edematous and frequently show protoplasmic branching. Twenty-four

to thirty-six hours before menstruation, there is an outpouring of many polymorphonuclear leukocytes among the stroma cells of the compact layer. The endometrium at this stage bears some resemblance to the endometrium of pregnancy.

Before the work of Hirschmann and Adler, E. Novak and R. TeLinde,

Schroder, and others, the premenstrual endometrium, because of its vascularity, edema, and hyperplasia of the glands, was frequently diagnosed as chronic endometritis. This was the case with the curettings containing the famous Miller ovum⁴ the youngest human ovum yet described. It is interesting to note that in the same specimen another pathologist made a diagnosis of chorio-epithelioma, but it was later discovered by accident that this was really the chorionic epithelium of the embryo. It suggests, therefore, that curettings of premenstrual endometrium might well contain a young ovum.⁵

3. *Menstrual*.—The act of menstruation implies the loss of a varying amount of blood, but some doubt still exists as to the actual amount of endometrial tissue which is cast off at this time. One group of workers believe there is no loss of tissue, and the menstrual bleeding results from the rupture of small subepithelial hematmata, Figure 47. In their mind this is associated with a shrinkage of the endometrium without the loss of an appreciable amount of tissue, or "menstruation



FIG. 47.—MENSTRUATING ENDOMETRIUM.
THIRD DAY.

Note tortuous glands. Upper layers are poorly stained, crumbling, and there is an actual loss of tissue at one side. All the tissue filled with blood. This shows how upper layers of endometrium are cast off with menstruation or by the "menstruation by rhexis." X 44.

by diapedesis." They are led to this belief by finding small accumulations of blood immediately beneath the surface epithelium, the "subepithelial hematmata" of Gebhart, the great engorgement of the blood-vessels, and

⁴Streeter, "Contribution to Embryology," Carnegie Institution of Washington, No. 92.

⁵The Carnegie Laboratory of Embryology, Johns Hopkins Medical School, Baltimore, Md., receives material for careful study. Fix curettings, after washing free of blood in salt solution, in 10 per cent formalin.

considerable quantities of blood lying free in the tissues. We often see these hematomata beneath the surface epithelium connected with veins in the stroma, and in some places these can be seen raising the epithelium and discharging blood. Free blood can be found in the stroma. These are all shown in Figure 48, taken on the third day of menstruation.

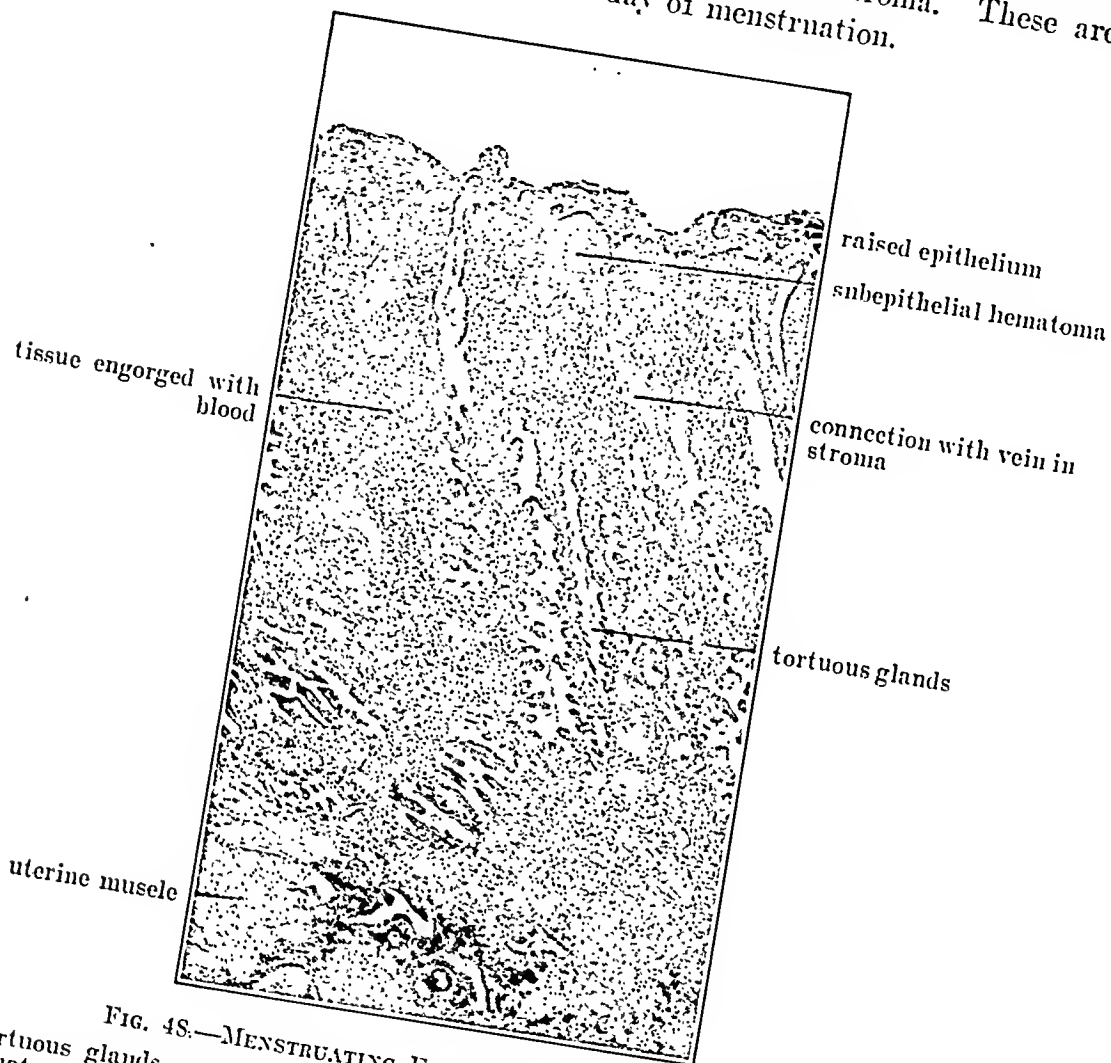


FIG. 48.—MENSTRUATING ENDOMETRIUM. THIRD DAY.

Note tortuous glands and stroma filled with blood. Surface epithelium is raised and a small hematoma can be seen beneath the surface, the subepithelial hematoma of Gebhardt, connecting with a vein at a lower level. This shows how menstruation occurs by the escape of blood from hematomata and the tissue, or "menstruation by diapedesis." $\times 44$.

Another group holds that menstruation is associated with an actual destruction of tissue and the casting off of the upper layers of the endometrium or "menstruation by rhexis," the compact layer and most of the spongy layer being cast off at this time, with regeneration of the endometrium from the basal layer. They base the discovery on finding endometrial tissue in the menstrual blood and the actual loss of tissue in the menstruating uterus, removed with the utmost care to preserve the surface of the mucosa. They describe the compact and spongy layers as dead-looking, staining poorly, and actually crumbling.

Such a picture is shown in Figure 47, on the third day of menstruation. This seems the more likely process; the preponderance of evidence is therefore that there is an actual loss of tissue at this time.

4. *Postmenstrual*.—Following menstruation, Figure 49, the endometrium is thinnest, about 1 millimeter, a marked change from the endome-



FIG. 49.—POSTMENSTRUAL ENDOMETRIUM.

Glands cut in transverse section, straight and small; stroma dense and compact. $\times 44$.

trium before menstruation. This decrease in size is due either to the actual loss of tissue or to a great shrinkage during and after menstruation.

The epithelium on the surface is low, cylindrical, or even cuboidal, and contains many mitotic figures. This extends down into the straight tubular glands. The dense stroma cells have relatively large nuclei and only a small amount of cytoplasm.

5. *Pregnant*.—The endometrium of pregnancy, Figure 50, is characterized by the development of decidua cells, beginning shortly after the imbedding of the impregnated ovum. The premenstrual endometrium undergoes still greater hypertrophy, the decidua cells in the compact layer become quite large and numerous, while the glands of the spongy layer are more dilated and tortuous. The great increase in the number of decidua cells causes the surface to become firmer and undulating, forming the decidua vera. Changes in the ovum and the formation of the placenta are discussed at length in textbooks on obstetrics.

The epithelium, at first tall, active, and secreting, becomes cuboidal and the cells show fatty degeneration. The glands, at first large and dilated, become narrowed and tubular at a later stage. The characteristic large, oval, closely packed decidua cells with round, pale-staining, vesicular nuclei are chiefly in the compact layer. The blood-vessels are increased in size, especially the veins, which are later invaded by the trophoblastic cells to form the intervillous spaces.

The underlying muscle in the vicinity of an embedded ovum is frequently

altered, being infiltrated by giant-cells, which appear as spindle-shaped, oval, or round masses of protoplasm containing two or three deeply-staining oval or round nuclei. If nothing but the muscle and these cells are seen, a malignant

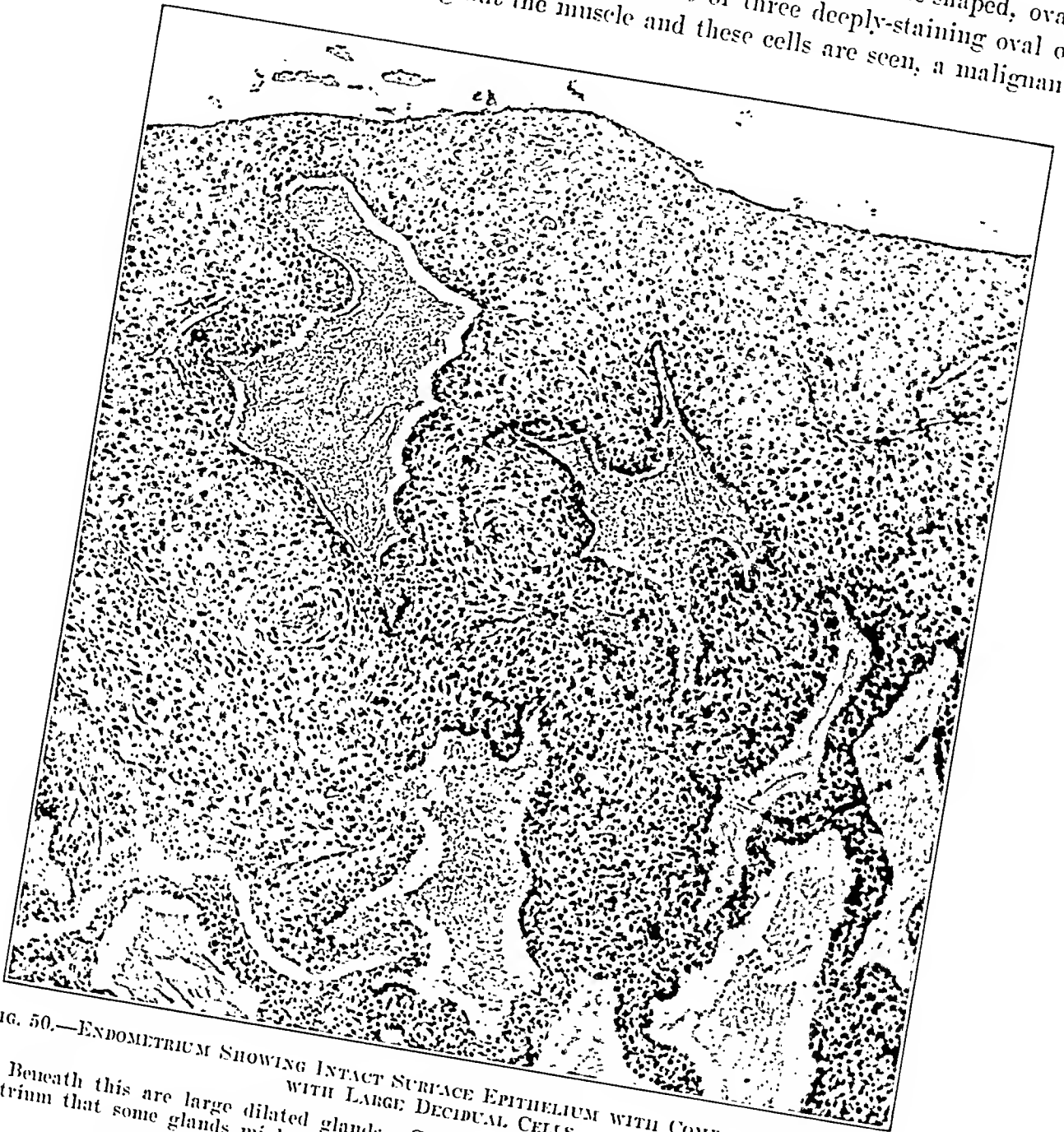


FIG. 50.—ENDOMETRIUM SHOWING INTACT SURFACE EPITHELIUM WITH COMPACT LAYER FILLED WITH LARGE DECIDUAL CELLS.
Beneath this are large dilated glands. Section taken through thinner portion of endometrium that some glands might be included.

tumor, or chorio-epithelium, might readily be suspected, but the subsequent finding of villi in the overlying endometrium would soon clear up this point. These cells extend quite deeply into the muscle, and probably originate in the connective tissue.⁶

⁶ Cullen, *Cancer of Uterus*, 1909.

Ligaments.—Extending from each side of the uterus are three ligamentous structures: Broad, round, and uterosacral.

Broad.—The broad ligament is a tentlike reflection of peritoneum, extending on each side from the lateral surface of the uterus to the pelvic wall, with the round ligament forming the ridgepole as it stretches from the cornu to the inguinal canal. The fallopian tube is posterior and superior to the round ligament and is covered by the same reflexion of peritoneum except at the fimbria, where the peritoneum is extended outward over the ovarian vessels to the pelvic wall, forming the infundibulopelvic ligament or suspensory ligament of the ovary, or suspensory ligament of Henle. The mesosalpinx lies immediately beneath the fallopian tube and is made up of loose connective tissue in which the blood-vessels to the tube and the parovarium are embedded. These can be easily visualized by holding this fold of peritoneum against the light.

The parovarium, which is the homologue of the epididymis in the male, and a remnant of the wolffian duct, lies between the peritoneal folds of the mesosalpinx. This consists of a number of narrow vertical tubes, which are usually connected at the upper end with a longitudinal duct lying immediately beneath the fallopian tube, and terminates at the cornu, although it may extend down the lateral surface of the uterus to the level of the internal os. These narrow tubules are lined by a low columnar epithelium. The wall consists of a fibrous coat with a definite circular, nonstriped, muscular layer, by which it may be recognized. The hydatid of Morgagni is composed of cystic accumulations in the vertical tubes of the parovarium and is attached by a slender stalk to the anterior surface of the broad ligament where it is continuous with the longitudinal duct. The hydatid consists of a fibrous muscular coat lined by a single layer of columnar epithelium and covered by a delicate prolongation of peritoneal tissue. Prolongation of the longitudinal duct may persist after fetal life and extend down along the cervix and anterior vaginal wall, when it is known as Gartner's duct. This canal is lined by a single layer of columnar epithelium. Accumulation of secretion in the duct results in cysts.

Between the folds of the broad ligament is a loose connective tissue. Where the peritoneum is reflected on the pelvic wall, the loose connective tissue becomes continuous with the connective tissue of the pelvic floor. The lowermost portion is quite thick and contains the uterine vessels and ureter. This is composed of dense connective tissue which becomes continuous with a muscular connective tissue band from the cervix and is known as the cardinal ligament of Koch, or the ligamentum transversali colli. The parametrium consists of connective tissue at the base of the broad ligament and is continuous with the connective tissue of the pelvic floor.

Round.—The round ligament on each side extends from the anterior and lateral surface of the uterus, between the folds of the broad ligament, and tra-

verses the inguinal canal to insert in the upper portion of the labium majus. This consists of a cord of nonstriped muscle, about 3 to 8 millimeters in diameter, covered by peritoneum on three surfaces and the loose connective tissue of the broad ligament on the lower surface. It derives its blood supply from vessels running in a longitudinal direction from the uterus.

Uterosacral.—These are two strong, fibromuscular bands arising from the posterior surface of the uterus near the internal os, and extending around the rectum to insert into the fascia covering the anterior surface of the second and third sacral vertebræ. They are covered by peritoneum reflected from the culdesac of Douglas, and exert considerable traction on the cervix.

Fallopian Tube.—A convoluted, conical, muscular tube, 8 to 14 centimeters long and 2 to 10 millimeters in diameter, covered by peritoneum and lined by epithelium, forms the tortuous canal through which the ovum must pass from the ovary to the uterine cavity. The peritoneal covering is complete except at the mesosalpinx, where the tube joins the connective tissue of the broad ligament through which it obtains its blood, nerve, and lymphatic supply.

The mucosa is thrown into longitudinal folds, progressing from the four simple folds at the cornu of the uterus, Figure 51, by con-

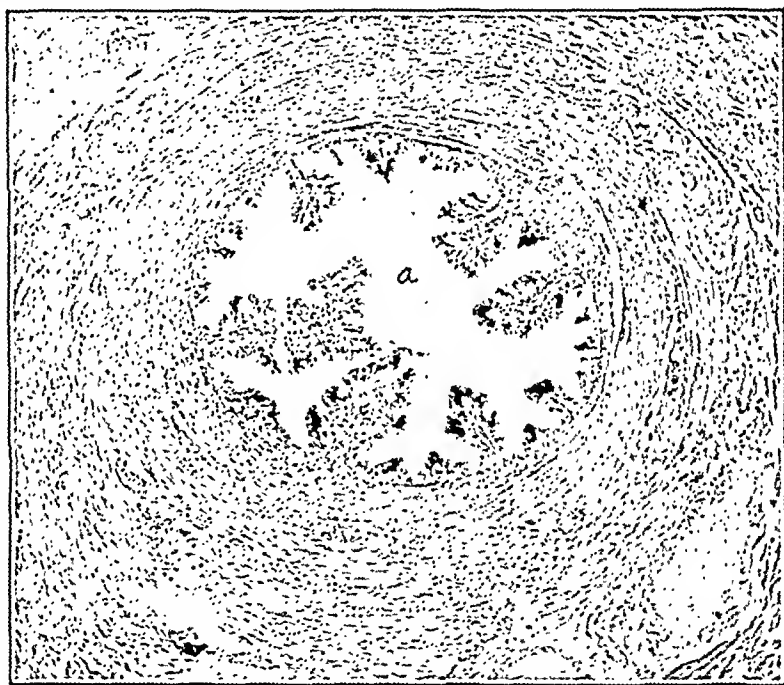


FIG. 51.—SECTION OF FALLOPIAN TUBE NEAR UTERINE CORNU SHOWING BRANCHING OF MUCOSAL FOLDS PROJECTING INTO LUMEN (a) OF TUBE, SURROUNDED BY CIRCULAR BAND OF MUSCLE AND, OUTSIDE OF THIS, LAYER OF LONGITUDINAL MUSCLE AND PERITONEAL COVERING.

Several large blood-vessels seen outside inner muscular coat.
× 40.

tinual branching to the more complicated convolutions in the ampulla. It may be likened to four railroad tracks, which by continuous division branch out into a great railroad yard. Within the uterine wall, the lumen is so small, 1 to 2 millimeters, that it will hardly admit a fine probe; the four projections at this point give the lumen the appearance of a Maltese cross. The isthmus, or narrow portion of the tube adjoining the uterus, has more numerous mucosal convolutions and extends into the ampulla. The infundibulum, or fimbriated extremity, is the large funnel opening of the tube to receive the ovum. One portion of this is

very adherent to the ovary, forming the tubo-ovarian junction, or the fimbria-tubo-ovarica.

The lining epithelium is columnar and ciliated and similar to the epithelium of the uterus, surrounded by a thin connective-tissue layer. Some mucus-



FIG. 52.—FALLOPIAN TUBE NEAR FIMBRIÆ.

Inner circular (*a*) and small portion of outer longitudinal (*b*) muscle-bundles of tube seen. Delicate folds of endosalpinx lie free in lumen with some free blood between. Columnar epithelium ciliated; some mucous cells seen scattered between. Ovum is propelled more by the muscular contractions of tube than by cilia. $\times 62$.

secreting cells, devoid of cilia, are scattered among the ciliated cells at all phases of the cycle. The folds of the mucosa give the appearance of papillary or tree-like projections into the lumen. There are no glands. Two definite layers form the nonstripped muscular coat, an inner circular and an outer longitudinal muscular layer, whose fibers are mixed with connective tissue.

Ovary.—The ovary, one on each side, is the sexual gland proper, in which the ovum is developed, from which it is liberated, and in which an internal secretion is elaborated. This flat, oval, irregular body varies in size with age, measuring 3 to 5 centimeters in length, 2 to 3 centimeters in breadth, and 8 to 15 millimeters in thickness during the active stage. A large follicle or a corpus luteum may greatly increase this size. In the young child the ovary is small and composed almost entirely of cortex which is filled with primordial follicles closely packed together. After the menopause, it decreases rapidly in size and shrinks to small proportions. At the hilum it is attached to the posterior surface of the broad ligament, the inner end is attached to the uterus by the utero-ovarian ligament, while at the outer end the ovarian vessels pass through the infundibulopelvic ligament to the hilum of the ovary. Its anterior surface is flat and the posterior surface convex.

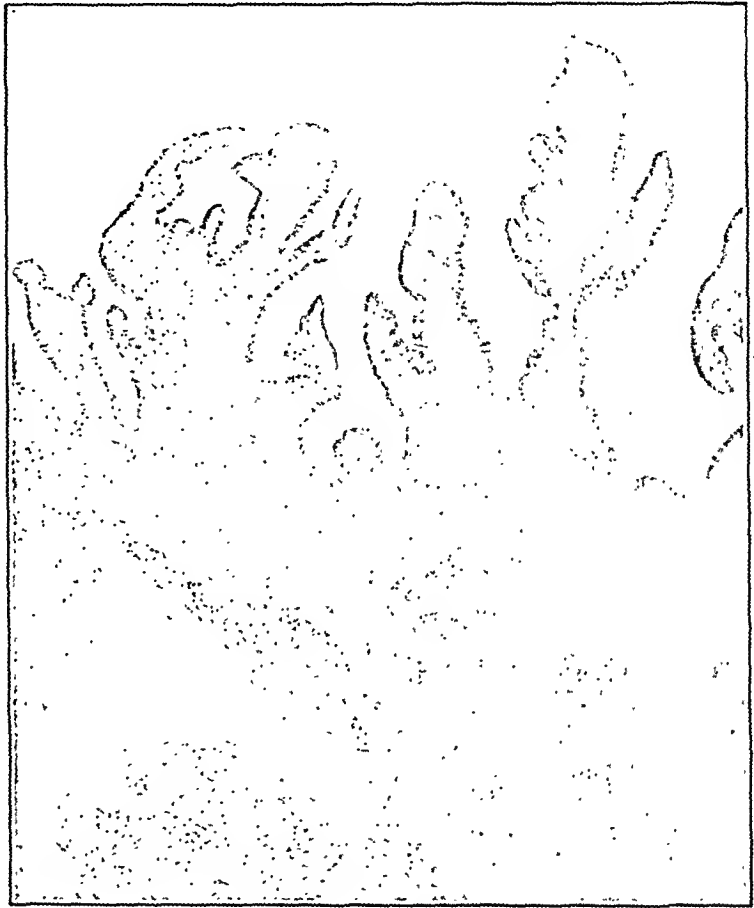


FIG. 53.—TUBO-OVARICA.

Epithelium of tube seen extending down along fold of broad ligament toward ovary. Blood-vessels and connective tissue of broad ligament seen beneath. $\times 38$.

The ovary is made up of two portions, the cortex and the medulla. The cortex of the ovary contains the characteristic component of the ovary, the graafian follicle, and is readily separated from the medulla which is made up of a large number of blood-vessels and loose connective tissue.

Cortex.—The surface is smooth and usually covered by a flat epithelium tending to become cuboidal in protected places and in clefts. In young children, the germinal epithelium can be seen occasionally dipping down into the stroma. Immediately beneath the surface the connective-tissue stroma is disposed with great regularity in a dense thin layer forming the tunica albuginea, Figure 54. Ova are usually absent in this layer. More loose spindle-shaped,

modified connective-tissue cells, and fibrous tissue arranged in all directions form the characteristic ovarian stroma.

Scattered through this are all stages of the *graafian follicles*, the characteristic components of the ovary. It is estimated that a hundred thousand exist at birth with only about thirty thousand present at puberty. In general, the undeveloped, or primordial follicles lie near the surface, the growing follicles near the central medulla, while the mature follicle appears as a large vesicle

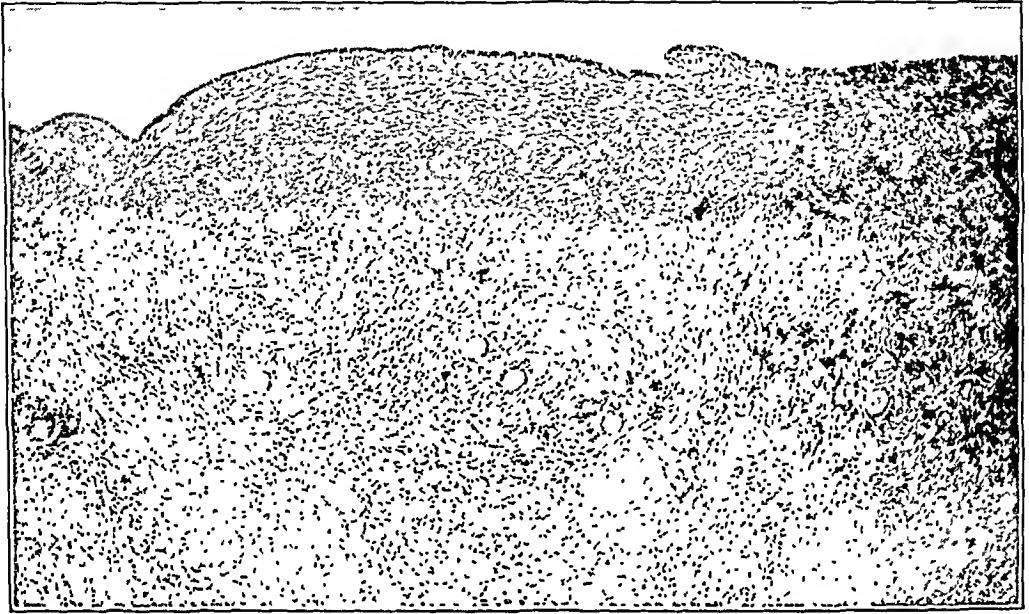


FIG. 54.—CORTEX OF OVARY.

Note surface epithelium is low cuboidal, as if overlying a protected place. Immediately beneath the epithelium a dense layer of stroma without follicles—the tunica albuginea. Beneath this, stroma irregularly arranged and containing characteristic component of ovary—primordial follicles. $\times 44$.

which may occupy the entire thickness of the cortex and produce an elevation on its surface.

The *germinal epithelium* is cuboidal but only present in protected clefts, or perhaps, in handling, it is rubbed off the surface of the ovary. Before birth, the change from germinal epithelium to primordial follicle is well-known, but so far no one has demonstrated the genesis of new ova from the germinal epithelium after birth; even in other mammals, such evidence as exists is inconclusive. The preponderance of opinion is that all the epithelial elements of the follicle, ovum, and membrana granulosa, arise from the germinal epithelium, while the theca externa and theca interna, connective-tissue elements, are derived from the ovarian stroma.

The *primordial follicles*, Figure 55, 40 to 60 μ , are derived from an early differentiation of the germinal epithelium. The central ovum, 40 to 50 μ , is surrounded by a single layer of undifferentiated, flattened epithelium closely adjacent to the stroma cells. These may develop, atrophy, or remain the same

size awaiting favorable conditions. Of the thirty thousand present at puberty, it is estimated that not more than three or four hundred mature; there is thus early a struggle for existence among the ova, even as later in life.

Proliferation of the epithelium to the single layer of cuboidal epithelium is the first sign of activity of a *growing follicle*. This continues until several layers of cuboidal epithelium encircle the ovum, and form the stratum granulosum. At the same time a change in the surrounding stroma condenses to form the theca, which soon divides into the inner theca interna made up of characteristic polygonal and spindle-shaped cells with many nuclear figures and numerous capillaries, and the outer theca externa, composed of concentric ovarian stroma. The ovum suddenly matures at this time, and is surrounded by its granulosa cells. At first solid, the follicle soon becomes vesicular from the activity of the epithelium. The zona pellucida and zona radiata now form around the ovum, which shows no further increase in size.

Due to transudation from the surrounding capillaries, actual active secretion of the intact granulosa cells, and vacuolization of the cells of the stratum granulosum, this fluid increasing rapidly now expands the developing follicle.

The *mature follicle*, Figure 56, is a large vesicle, 10 to 20 millimeters in diameter, and may occupy the entire thickness of the cortex. Two definite layers can be distinguished in the surrounding stroma. The theca externa consists of ordinary ovarian stroma concentrically arranged. The cells of the theca interna are larger, more granular, polygonal, and some spindle-shaped, and show many mitotic figures. Blood-vessels are more numerous. A single layer of cuboidal cells separates the theca interna from the membrana granulosa, the membrana propria. Layers of irregularly arranged cuboidal epithelial cells with dark almost central nuclei form the stratum granulosum and surround the space filled with liquor folliculi. The ovum remains embedded in a proliferation of granulosa cells. This mass, the cumulus or discus proligerus, encloses the ovum by a few radial layers of cuboidal epithelium derived from the granulosa, the corona radiata. A narrow membranous layer of cells from the corona radiata forms the zona pellucida. This encloses the perivitelline space which allows the ovum to rotate so that the discus always remains up. No vitelline membrane has ever been demonstrated for any mammal.



FIG. 55.—GRAAFIAN FOLLICLE. EARLY.

Ovum is surrounded by single layer of cuboidal epithelium. No change has occurred in surrounding ovarian stroma to form the theca. $\times 420$.

The cytoplasm of the ovum, now 150 to 300 μ , has a peripheral clear zone and an inner dark one due to the irregular refractile yolk particles. The nucleus, 30 to 45 μ , is eccentrically placed and the nuclear membrane contains the nucleolus, or germinal spot, 4 to 8 μ , and the nuclear reticulum. An impairment of the blood supply to the most distended part of the follicle results in necrosis and rupture at this point, and probably determines the point of rupture.

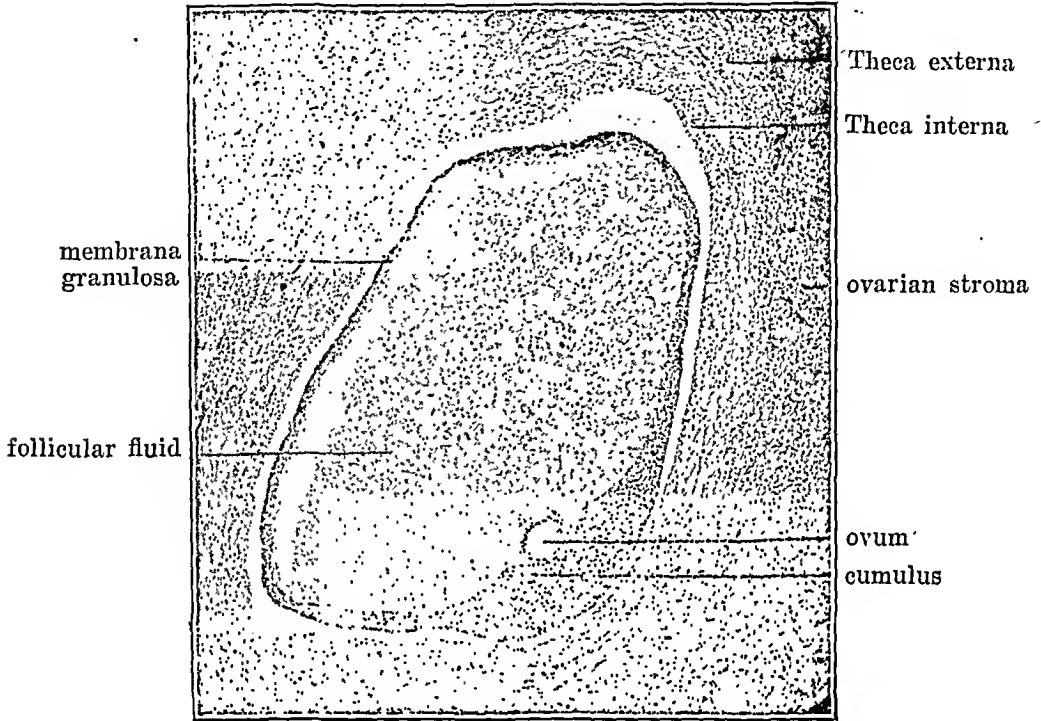


FIG. 56.—MATURE GRAAFIAN FOLLICLE.

Artificial separation of membrana granulosa and theca interna. Theca externa and surrounding ovarian stroma shown. Ovum embedded only partially in the piled-up granulosa cells, or cumulus, but a definite zona radiata can be seen. Follicle filled with fluid. $\times 162$.

Failure of the follicle to mature results in the *atretic follicle*. In any normal ovary hundreds of these atretic follicles can be found of varying size. Lying free in the liquor follicularis the cells of the cast-off membrana granulosa show a fatty degeneration with or without leukocytic invasion. Lutein-like changes occur in the theca interna where there is a cellular proliferation of the theca cells and an increase in the blood supply. These follicles may become quite large, forming persistent follicular cysts—the cystic ovary.

The theca interna cells of the atretic follicle hypertrophy until they come to resemble lutein cells both in size and lipid content. With the final disappearance of the granulosa cells, the theca takes on the characteristic form and arrangement of the so-called interstitial tissue, or gland. Normally the process is not very marked and the existence of true interstitial tissue has been denied

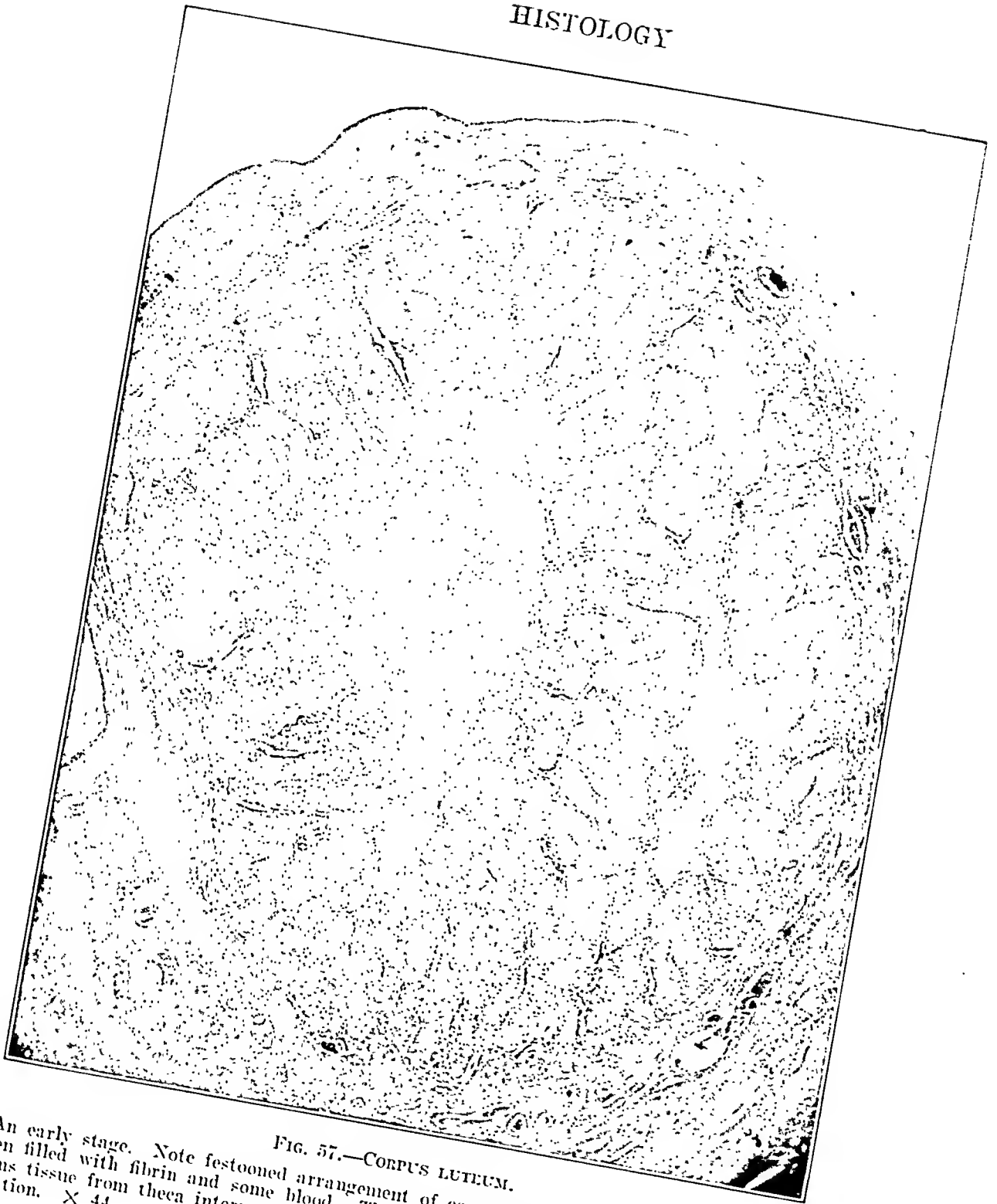


FIG. 57.—CORPUS LUTEUM.

An early stage. Note festooned arrangement of corpus luteum cells surrounding central lumen filled with fibrin and some blood. There has been little invasion of lutein cells by fibrous tissue from theca interna. Individual lutein cells not easily studied with this magnification. $\times 44$.

in the human ovary. During pregnancy the theca often hypertrophies to form what appears to be glandular tissue. Formation of the *corpus luteum*, Figure 57, immediately follows the rupture of the graafian follicle with the discharge of the ovum and the follicular

fluid, which is followed by a varying amount of hemorrhage. Hemorrhage into the cavity is followed by a rapid proliferation of the lutein cells containing a yellow pigment, either carotin or a more complex organic substance. The organized blood-clot is invaded by vascular connective tissue receiving its blood supply from the more numerous blood-vessels in the surrounding stroma. Obliteration of the cavity is completed by the proliferation of the lutein cells surrounding the central core of connective tissue and some shrinkage, giving the characteristic festooned appearance. The lutein cells are large, polygonal cells with small, round, faint nuclei and a granular protoplasm filled with a yellow pigment resembling cells of the adrenal and liver to some extent. If

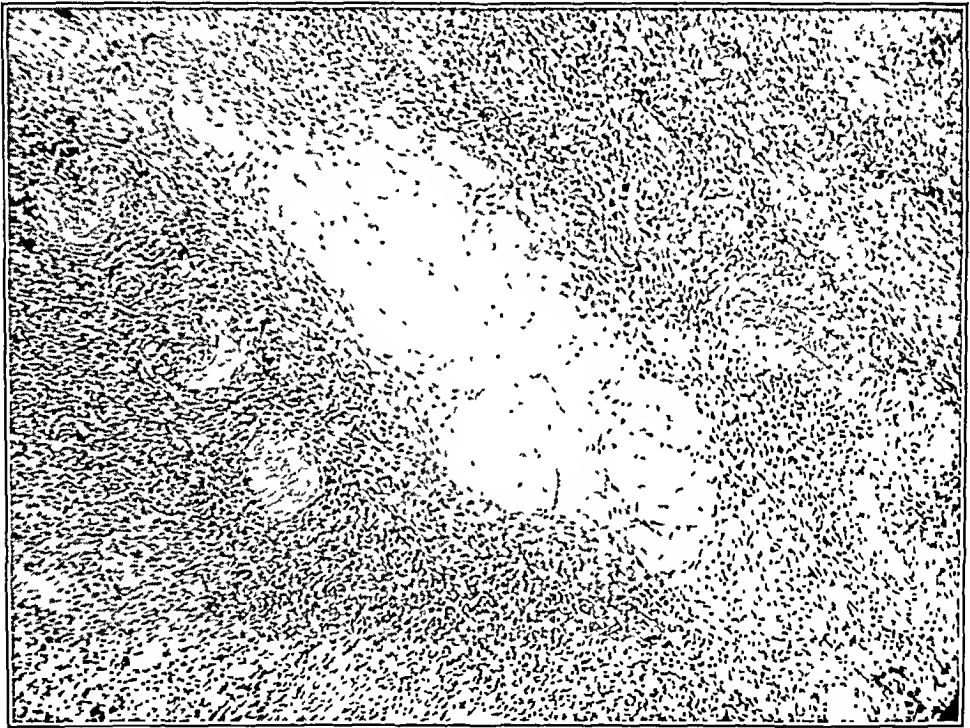


FIG. 58.—CORPUS ALBICANS.

Clear hyaline corpus albicans takes almost no stain. Strands of surrounding ovarian stroma seen invading hyaline mass, eventually absorbed. Ovarian stroma adjacent contains many blood-vessels. $\times 48$.

pregnancy supervenes, this continues throughout as the corpus luteum verum, where no degeneration takes place until the eighth or ninth month of the pregnancy. If impregnation does not occur, it is often referred to as the corpus luteum spurium. There is no anatomical basis for this differentiation.

Retrogression, or degeneration, of the lutein cells begins with the onset of menstruation. Fat can be demonstrated in the lutein cells, while fibrous strands and many blood-vessels grow in from the surrounding stroma. Leukocytes engorged with blood pigments are scattered through the organized blood-clot. Fatty degeneration of the lutein cells and hyaline degeneration of the connective tissue follow.

The *corpus luteum of pregnancy*, either solid or cystic, is usually larger, due to the increased blood supply associated with pregnancy. It is often cystic, especially during the first half of pregnancy from the liquefaction of the blood-clot, forming a cyst lined by a well-developed layer of connective tissue. The lutein cells are large, clear, and contain globules of neutral fat.

Replacement of the lutein cells and connective tissue by homogeneous, clear, nonfibrous hyaline tissue forms the *corpora albicantia*, Figure 58. This retains the festoon arrangement and contains a few connective-tissue fibers with some degenerated blood-vessels. They frequently contain brown granular pigment in which iron has been demonstrated. Gradual invasion by the stroma breaks the hyaline tissue into smaller masses, which are eventually absorbed. The rate of absorption varies with the age and the blood supply, being completed rapidly in the young, but more slowly as age advances.

The origin of the lutein cells is not clear. Some believe they arise from the membrana granulosa, and describe lutein changes in this layer. They contend the membrana granulosa is not cast off, but proliferates, and is separate from the theca interna. On the other hand, those that believe they arise from the theca interna, contend that the membrana granulosa is cast off with the ovum, and that fatty changes take place in this layer before rupture of the follicle. They also point out luteinlike changes in the theca interna before rupture of the follicle and point out this layer as the origin of the multiple lutein cysts associated with hydatidiform mole, or chorio-epithelioma. The preponderance of opinion is that they arise from the membrana granulosa.

Medulla.—The central zone of irregularly arranged connective tissue, rich in elastic fibers and blood-vessels, forms the medulla. Many of the blood-vessels are surrounded by tracts of smooth muscle continuous with the utero-ovarian ligament. Occasionally short ducts, lined by a single layer of columnar epithelium, are found and are probably remnants of the rete ovarii or the wolffian bodies. Their function is not clear. Islands of large, clear, polygonal cells, resembling stratified epithelium, are frequently found in both the medulla and the cortex. These medullary cords are believed by some to represent included portions of the wolffian body, while others state that they represent the remains of the germinal epithelium and are homologous to the seminiferous tubules of the testicle.

Secretions.—That hormones controlling the growth of the genital tract, the mammary glands, and the development of the female secondary sex characteristics emanate from the ovary is a settled fact, but there is little agreement as to the source of the hormone or hormones in question. At present, the liquor folliculi and the corpus luteum are the subjects of intensive study.

CHAPTER III

THE GYNECOLOGICAL EXAMINATION

HOWARD A. KELLY

DORSAL POSTURE

Inspection

VULVA

OUTLET

HYMEN

Digital Examination

Bimanual Examination

INVAGINATION OF THE PELVIC FLOOR

UTERUS

OVARIES

UTERINE TUBES

URETERS

EXAMINATION BY RECTUM AND ABDOMINAL WALLS

EXAMINATION BY RECTUM AND ABDOMEN AFTER ATMOSPHERIC DISTENTION OF RECTUM

EXAMINATION WITH RETROPOSED UTERUS

EXAMINATION WITH UTERUS PULLED DOWN TOWARD VAGINAL OUTLET

EXAMINATION OF ANTERIOR SURFACE OF UTERUS THROUGH RECTUM

UTERINE SOUND IN DIAGNOSIS

SIMS POSTURE

KNEE-CHEST POSTURE

EXAMINATION OF CHILDREN AND YOUNG GIRLS

EXAMINATION OF THE RECTUM

Palpation

Inspection

SEAT OF PAIN

EXAMINATION UNDER ANESTHESIA

EXAMINATION OF THE ABDOMINAL ORGANS

Inspection

The consulting room should be bright, attractive, well-ventilated, and clean. The examining room should be adjoining with a simple upholstered table, Figure 59, a lavatory and toilet facilities, plenty of clean sheets, and the necessary instruments and a sterilizer at hand. If possible a nurse should always be present to prepare the patient for examination and lend aid in such other ways as her abilities and training make possible. Some of our best coadjutors, laboratory technicians, and skillful anesthetists are our nurses, or even

women without a degree inducted into their duties for which they show an aptitude.

The natural sequence in arriving at a diagnosis is first to hear the patient's own account of her symptoms and then to ask sundry leading questions relating to past history and present complaints sufficient to furnish a skeletal outline on which to build subsequently. An interested attention and patience do much to win that confidence which is so necessary through all the subsequent stages in the professional relationship. Not infrequently the maze of diagnostic possibilities suddenly opens up and time is saved as a patient abruptly

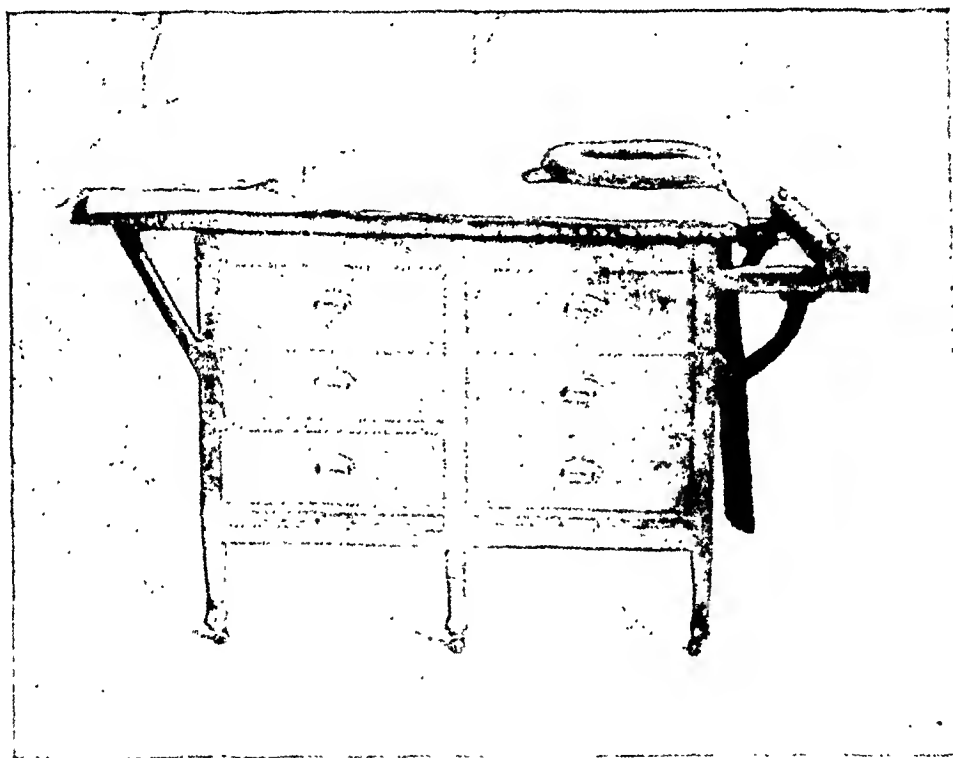


FIG. 59.—GYNECOLOGICAL EXAMINING TABLE.

Top is covered with leather, well padded, on which is blanket covered with linen sheet. Drainage cushion is serviceable in protecting table from contamination of discharges. I sometimes use a much smaller cushion than that figured. Drawers serve for storage of clean linen, towels, dressings, pessaries, etc.

announces, "Doctor, I have a fibroid tumor," or "I have a cancer," or a "falling of the womb," or her physician writes, "My patient has such and such a disease."

It may be well after noting a few outline facts, such as married or single, age, incidents of childbearing, character of the menstrual flow or other discharges, and the pain and its location, to proceed at once with the local examination, returning to the history to fill in the details later. It is always well to note previous treatments and the opinions of the other physicians consulted. In my own experience, it not infrequently transpires that the patient has been informed that she has a cancer, and although she may also have sundry other

minor disabilities, she will rest perfectly satisfied if relieved of this one great fear. Of all the factors in the examination and subsequent treatment, a genuine zealous kindly interest is without doubt the most important.

All histories must be registered with consecutive numbers and kept on file on cards or on special sheets in envelopes available at any time. Only a poor surgeon neglects his histories; a clear, well-kept record may save much embarrassment at a later date in many ways. It is well often to record in quotation marks the patient's chief complaints in her own words; this serves to keep certain salient factors before one and may prove of value in a later effort to estimate the amount of improvement. I always blue pencil symptoms upon which she is inclined to lay stress. With each history, letters from the patient and her physician are also filed. On the front page, note "Sent by Dr. ———" as a continual reminder of the courtesy due the home physician and the need of coöperation with him after the patient has left the hospital. Some such outline as the one appended will be found helpful, Figure 60.

The special local must be followed at once in almost all instances by a thorough general examination, including a careful note as to the presence or absence of focal infections—on the condition of the tonsils, fauces, and teeth, any history suggestive of previous aural infection or sinusitis—the condition of the thyroid and cervical glands, urinary function with phthalein output; then follows blood, cardiovascular (blood-pressure), Wassermann reaction, sometimes glycemia, calcium, urea, and nonprotein nitrogen, various x-ray examinations, and further data secured by coöperation with sundry specialists. One of our greatest needs to-day is that of competent pathologists in all large centers. Many are the mistakes made by tyros. We will get the pathologists only when we pay adequately for their services. One of the best diagnosticians in this hemisphere gives his patients a list of specialists with a brief line to each, requesting him to report what he finds in his own domain. The patient returns in a week or more with a sheaf of data, which he coördinates with his own history and examinations and prescribes treatment, surgical or medical. It has become impossible to do justice to our patients without access to a well-equipped laboratory either in one's own home or hospital or maintained by a group of physicians working in harmony or with the board of health coöperating.

It is a common error on the part of some excellent men to land a patient in a hospital like a fish in a net and to keep her for weeks to make a leisurely diagnosis easily arrived at within a few hours (sometimes minutes), incurring needless expense, wasting time, and congesting the hospital and lessening its turnover.

It is a fair question whether our recent remarkable developments in laboratory methods and instruments of diagnostic precision are not tending to make many poor diagnosticians. It would seem that the average patient would be better served if she could count on the concentrated personal interest of her

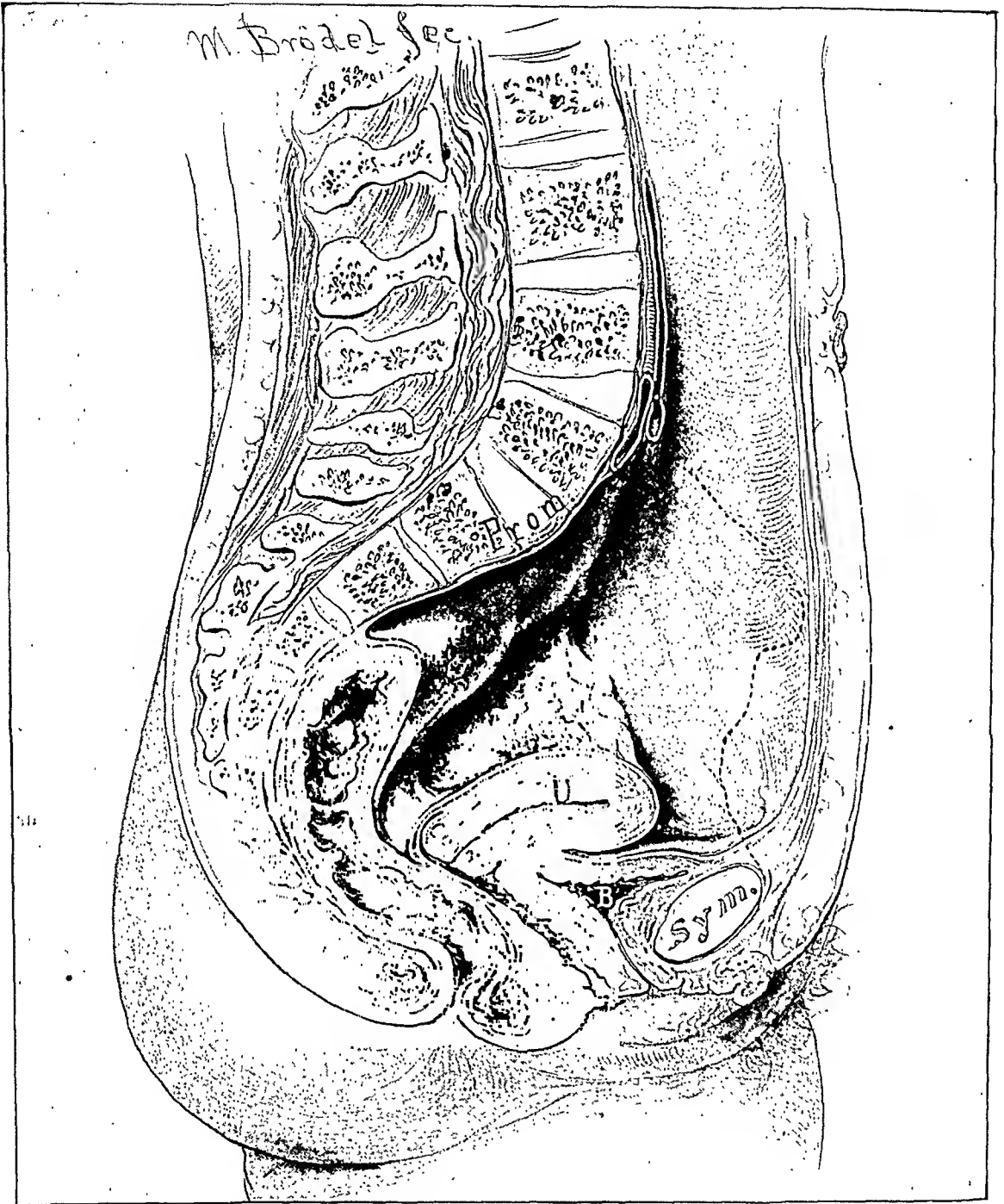


FIG. 61.—SAGITTAL SECTION THROUGH ADULT BODY, SHOWING NORMAL POSITION AND RELATIONS OF UTERUS, BLADDER, RECTUM, AND ABDOMINAL WALLS.

Intestines not shown; dotted line represents outline of pelvic bones. Note proximity of anterior abdominal wall to sacral promontory.

skilled physician for something less than a half hour of history taking and for a like period in a painstaking physical examination. The occasional patient must obviously have recourse to other consultants and sundry special examinations, but the wise family physician who has initiated the diagnostic inquiry with a strong sense of his personal responsibility will usually know how to

curtail these special examinations in the interest of great saving of time and expense and to the ultimate advantage of the patient.

The gynecological examination is made with the patient on a simple table with a foot support, in one or more of several postures, facilitating the access of the surgeon's hands and fingers to the intrapelvic organs. These postures are: The dorsal—limbs flexed and drawn up, the so-called lithotomy posture; the lateral procumbent, called the Sims posture; the knee-chest.

I shall refer to the various instruments used as the methods are described.

A cardinal principle in the examination is to give as little pain as possible; invariably gentleness with encouragement and a judicious persistence will accomplish far more than forcible or rough manipulations, and, too, it has the advantage of impressing the patient with her physician's skill.

DORSAL POSTURE

Inspection.—*Vulva.*—The external parts are naturally inspected first and any alteration in form or color noted. Commonest ailments are pruritus with marked reddening and scratch marks, or in its more advanced forms with sclerotic whitish areas (kraurosis), furunculosis, condylomata, a fatty tumor, and, rarely, a hernia extending down into a labium or a hydrocele. The labia minora are subject to great variations in size, from small inconspicuous objects all the way to the formation of rugose conspicuous projecting folds (Hottentot apron). A greatly elongated labium minus is often evidence of manipulation. The clitoris is sometimes a source of marked irritation from the accumulation of smegma under the prepuce. The hood often adherent has been greatly exploited by quacks. Syphilis may form a chancre of the vulva, and a hard lump, ulcerated or not, may be a carcinoma. In both of the latter instances, the glands of the groins should be carefully examined for any enlargement. Advanced syphilis produces extensive ulcerations and lesions resembling elephantiasis.

Outlet.—When the lips of the vulva are parted to expose the vaginal outlet, one notes first the presence of a discharge and its nature—whether bloody (menstruation, cervical polyp, tumor above, cancer), or clear albuminous, or whitish, or purulent (infected vagina, cervix, uterine tubes). The urethra should be noted, whether closed by its labia or everted red and exposed and sensitive to touch.

Hymen.—The virginal hymen is sharp-edged and prevents the entrance of more than the end of the finger; when it is intact it should be let alone except under stringent necessity and the examination completed through the rectum, and if need be under anesthesia. The hymen relaxed enough to admit two or more fingers easily and with no distress to the patient almost invariably presents evidence of coitus, previous examinations, manipulations by the patient herself, the habit of douching the vagina, or childbirth. As a rule, the readi-

ness with which a young woman approaches a digital examination conveys a broad hint as to the status of the hymen.

Digital Examination.—In beginning the vaginal examination, the first test applied at the outlet is the estimation (1) of any undue sensitiveness (vaginismus), (2) of its supporting power or laxity, and (3) of the presence of enlarged glands, Skene's or Bartholin's. In a normal orifice, the supporting levator muscles on each side are so knitted to the sides of the terminal bowel and the internal sphincter that the sensation conveyed on introducing one or two fingers is that of a firm resilient transverse bar stretched across behind and holding up the orifice. If the patient is told to bear down and then draw up as in an effort to restrain a bowel movement, the finger is grasped by a sort of shearing movement between the levators and the pubic arch. On the other hand, a broken-down outlet is often so lax that the examiner can even use his fingers as a speculum to retract the perineum and expose the cervix. The condition of the vaginal walls is important. In the young, they are generally rugose and the anterior wall in its suburethral section is rough and ridged, a cushioned prominence with a sulcus on both sides; sometimes the suburethral cushion is fissured longitudinally. With age and notably with childbearing, these superficial landmarks are smoothed out until in the aged the walls are characteristically smooth and thin. Some vaginas are deep, while others are preternaturally short. The depth can be measured by pushing the index finger up to the posterior vault (posterior fornix) and then indenting the skin on the radial aspect of the hand with the finger nail, just under the pubic arch—10 centimeters or more in a deep case and not over 6 in a shallow one. In the latter instance, the uterus is almost always found in what may be termed physiological retroversion. The cervix lies well back toward the sacral hollow or in descensus, or, rarely, displaced to one side, pulled up, or jammed behind the symphysis by a pelvic tumor. The size and consistency and appearance of the cervix and the status of its orifice (*os uteri*) and the presence of retention cysts, a polyp, an ulceration (cancer?), any laceration, or a friable vegetative mass should be noted with extreme care. The degree of its descensus toward the outlet is best estimated with the patient erect with one foot on a low stool and straining a little.

If the patient has borne children, it is well next to tell her to strain, to bear down as in having a stool. When the outlet is broken down and the inferior supports are lacking, the anterior and posterior walls of the vagina (one or both) roll down and out, showing relaxation and displacement.

The digital examination also notes any lump or cyst in the vagina.

A specular examination of the vagina, vaginal vault, and cervix now follows. I like best a Goodell bivalve or a Nelson trivalve instrument, Figure 62; the speculum is introduced by retracting slightly the posterior wall of the outlet, spreading it a little, and then resting the lubricated speculum blade at this point and slipping it backward, down, and in. As the blades are spread,

the cervix comes into view in the lumen. The first thing to note is the presence and amount of secretion present and its source, whether cervical, vaginal, or both.

The nulliparous cervix is smooth and firm with a little dimple or small transverse orifice to mark the external orifice of the womb in the virginal nulliparous os, or again, in the parous, it is more or less transversely lacerated and in varying degrees everted. It is important to note carefully the exact appearance of the cervix, whether puffy and enlarged or cystic or showing around the opening the red everted mucosa of the cervical canal erroneously called an "erosion," and often by gross error following the mistakes of an earlier generation dubbed an "ulcer of the womb"; any sprouting granulations or excavated true ulcer should be viewed with suspicion as possibly cancerous (see malignant tumors of the uterus). One should also note the character of the little plug of mucus seen in the os. If this is pellucid, clear, and small in amount, it is not likely that there is any marked infection either of the cervix or of the uterus above; it also liberates the cervix, itself, from the suspicion of involvement in any purulent leukorrheal discharges.

The reaction of the secretions should be tested as of value in determining the cause of sterility as well as helping to settle the question of a gonorrheal infection. Danin (*München. med. Wchnschr.*, May, 1925) declares that an acid intermenstrual reaction excludes gonorrhea; this has been confirmed by Leo Brady in forty-nine out of fifty examinations, and needs further investigation and confirmation.

The cervical canal is the frequent seat of polypi, varying from small red mucous growths up to those 1 or 2 centimeters in diameter. Larger fibroid uterine polypi may also be present here. A polyp discovered in this way sometimes relieves a serious situation by explaining at once the source of wasting hemorrhages.

When investigating the cause of sterility, the reaction of the secretion within the os and that on the surrounding vaginal portion should be tested with litmus-paper.

The vagina is best examined in one of two ways. As the speculum is withdrawn, the vaginal vault and the walls of the tube are inspected for accumulated secretions, red patches, or a general redness due to inflammation or congestion. A cyst in the walls is obvious and any cancerous condition primary or implanted from the uterus. The entire vagina is, however, always

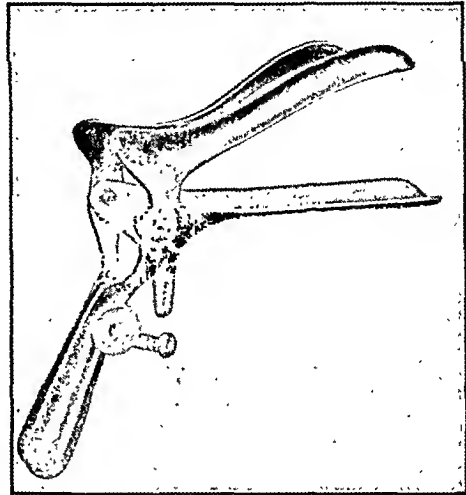


FIG. 62.—NELSON TRIVALVE SPECULUM, OPEN.

best seen with the patient in the knee-chest posture with its walls spread out for easy inspection and if need be for direct topical treatment.

Bimanual Examination.—The bimanual examination is made with one or two fingers of one hand in the vagina while the other hand coöperates to make

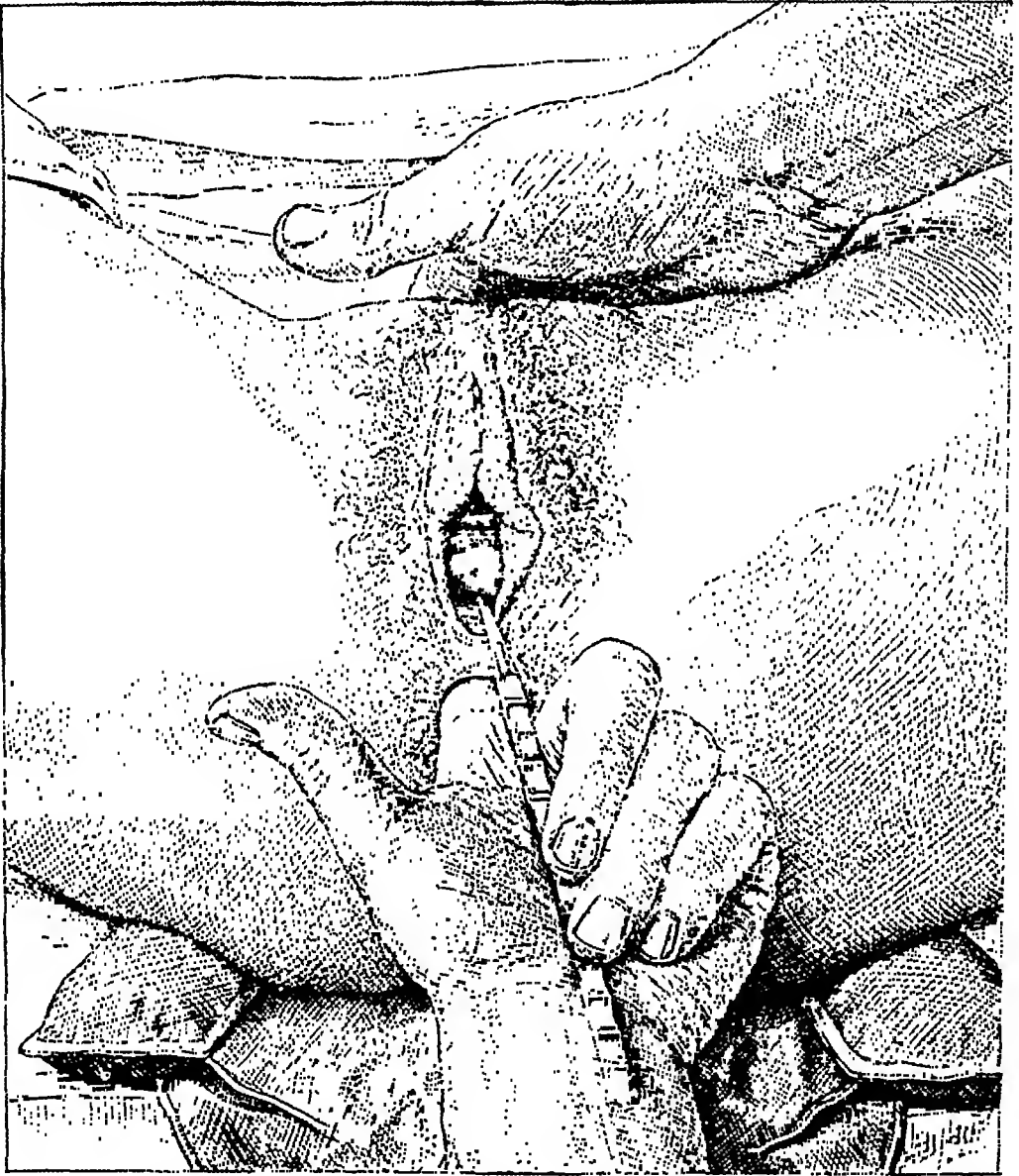


FIG. 63.—BIMANUAL EXAMINATION WITH UTERUS IN ARTIFICIAL DESCENSUS.

Cervix caught with corrugated tenaculum and drawn down to outlet; tenaculum held against ball of thumb, while index finger is inserted into rectum and used, in conjunction with abdominal hand, to examine pelvic organs.

pressure down into the pelvis from above and behind the symphysis. A further method of value I call trimanual as it is effected by grasping the cervix with a bullet forceps or other tractor held by an assistant and so fixing it or pulling it down, while both hands are used to make a bimanual examination through rectum and abdomen, Figure 63.

The success of the bimanual examination depends upon some degree of invagination of the abdominal wall through the superior strait, with one hand (in my own case, the right), while with the other the examination is conducted through one of the inferior straits, vagina, or rectum. The index finger, or index and middle fingers, if the vagina is lax, is introduced as far as the cervix. The palmar surface of the end of the finger is used in palpating; it is a begin-

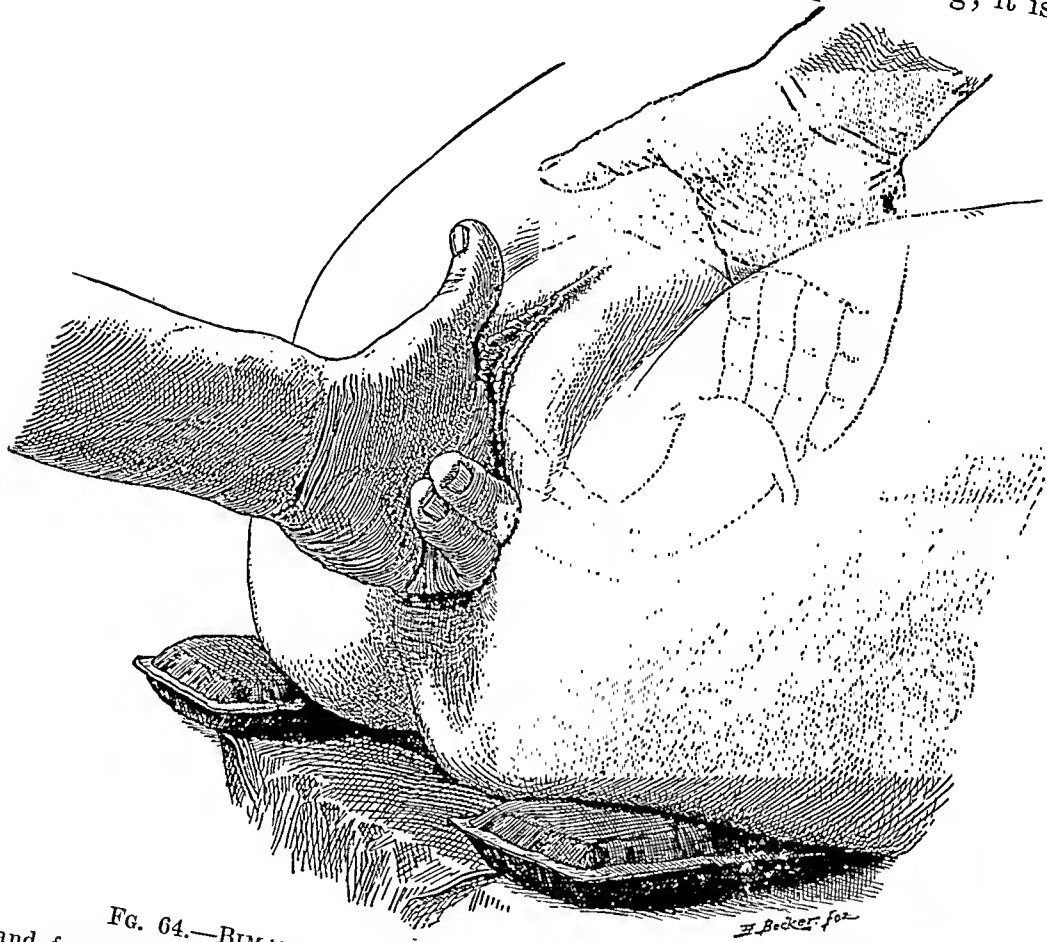


FIG. 64.—BIMANUAL EXAMINATION OF PELVIC VISCERA. Third and fourth fingers flexed upon palm and pelvic floor invaginated, adding an inch or more to length of fingers. Left view.

ner's error to use the radial side of the finger. There are two postures of that part of the vaginal hand which remains outside during the examination—either the fingers are flexed in the palm, Figure 64, or the thumb and fingers are held widely separated, the thumb resting upon the symphysis and the unemployed fingers on the perineum. Simultaneously with the introduction of the finger into the vagina, a gentle increasing pressure is made with the finger tips pressing down through the superior strait. An excellent way to outline the pelvic structures and their varying resistances by the vaginal finger is to traverse the whole lower abdomen with a slight,

jogging, vibratory movement, imparting to the underlying structures a succession of rapid succussions or little quick jolts at once detected by the vaginal finger. The revelatory character of such a simple gentle examination is surprising.

As a rule, but little force is called for to effect a complete and satisfactory examination; at times, it may be necessary to overcome the natural resistance of the walls by making a gradually increased pressure downward until the pelvic structures can be felt and outlined. The outlines of the pelvic organs while appreciated are not minutely examined by the abdominal hand which offers rather a plane of resistance, somewhat depressing the structures and preventing an upward displacement and slipping away of uterus and ovaries while under investigation by the vaginal touch. When the abdominal walls are thin and lax, then the outer hand often comes into play in feeling the outlines of the several organs. The abdominal hand does its best work in appreciating the consistency and outlines of tumors projecting up into the superior strait.

If the patient indulges her natural propensity and draws her thighs forcibly together and stiffens her abdominal walls, the examiner must either divert her, making her forget what he is doing, or tell her to open her mouth and breathe freely, or, if she persists, postpone the case for examination under anesthesia.

In the late eighties, a group of gynecological youngsters made a shibboleth of the bimanual examination, deciding upon a claimant's status as a gynecologist according as he held it indispensable or not, for the older men almost invariably used only "le toucher," the one-hand vaginal examination, and made their diagnoses accordingly. The natural limit of this last group was the vaginal cervix.

Invagination of the Pelvic Floor.—In spite of the assistance given by the external hand, the bimanual examination would often prove unsatisfactory if the vaginal hand were limited by the actual length of the average index and middle fingers. Some degree of invagination of the pelvic floor, therefore, is a necessary adjuvant, practically lengthening the examining finger and extending the excursus from 4 to 6 centimeters. This is done by inverting the perineum or the anal orifice up into the pelvis. The pubic arch and the tuberosities of the ischium sometimes impede the invagination, but a skillful examiner overcomes this by cramping his fingers a little more or by making the pressure at a point further back. Another difficulty in the way of securing the fullest advantages of this method of examining is the involuntary stiffening of wrist and finger muscles, which can be overcome by pushing only from the elbow, leaving the hand perfectly flexible and not interfering with the delicacy of the tactile sense. Where resistance is too great or the act is tiresome, the examiner will help himself materially by supporting his elbow against his pelvis or knee and pushing these supports so as to relieve the arm.

Uterus.—The examination of the uterus begins with the vaginal finger giving the cervix a slight blow, sending it upward at the moment the abdominal

hand bears down upon the same spot. Several such movements rapidly repeated in front of and behind the cervix at once locate the body of the womb as in anteposition, retroposition, or in a more or less erect posture. When the fundus lies in advance of the cervix, by sliding the vaginal finger gradually forward, bringing the abdominal hand a little closer to the symphysis, and pressing downward, a plane of resistance is furnished against which the vaginal finger rolls and palpates the whole organ.

If the uterus is upright, that is to say approximately in the axis of the pelvis, this is appreciated by carrying the abdominal hand a little further back and with a gentle to and fro play easily outlining the resistant areas and fixing its position. When the fundus is retroflexed, the direction of the cervix is more in the axis of the vagina with a rounded body behind and an absence of a resistant body at any other point. A condition is often found which I call a reclining uterus with the body lying back and resting in the lower sacral hollow. In parous women, a retrodisplacement usually also connotes some degree of descensus toward the vaginal outlet which is best appreciated by examining the patient standing while bearing down, when the cervix will be felt approaching the vaginal outlet.

Ovaries.—Pushing the finger up into the lateral fornix and out toward the pelvic wall, while making deep pressure in the same direction with the abdominal hand, the movable amygdaloid ovary is caught and outlined. It is not enough simply to appreciate its resistance; it must be caught and allowed to slip between the fingers in various directions until it has been examined on both surfaces and its free border. The perfectly normal ovary is often quite sensitive, and one must not infer because the patient winces or cries out that the organ is diseased or that there is a surrounding inflammatory zone. Any excessive tenderness, as found in neurotics, increase in size or fixation, as well as displacement, are to be noted. A bimanual recto-abdominal examination reveals the ovaries still more plainly; from this vantage point the finger can be passed under the ovary, lifting it and easily detecting any light adhesions or small cyst. The left is felt most readily.

Uterine Tubes.—These structures in their normal condition are not easily felt through the vagina, but if thickened by disease, the uterine end may be rolled between the fingers like a cord traceable outward toward the pelvic walls. Pus-tubes and other cystic tubes form a mass often of cornucopia shape, sometimes fluctuating and tender, sometimes firm and resistant, in one or both posterior pelvic quadrants.

Ureters.—The ureters as first noted by Chrobak and Sängner among the most important pelvic landmarks, are too often ignored in the bimanual examination. To locate a ureter, the index finger first rests on the tip of the cervix. The examiner then mentally locates the ureterovesical orifice anterior and slightly lateral to the cervix. Beginning at this point, the index finger gently sweeps diagonally across the vaginal vault in a direction calculated to cross

the ureter at right angles as it descends from the base of the broad ligament. In thin individuals the ureter can easily be rolled between the abdominal and vaginal fingers. In pyelitis, the inflamed ureteral mucosa often presents a wirelike thickening, while in tuberculosis there is likely to be a general nodular thickening of the entire wall like a string of beads. A calculus within 6 centimeters of the bladder can be outlined, in the absence of much periureteral thickening. A ureteral stricture is often palpable, and sometimes the node of infiltration is so well defined as to be mistaken for a stone. In inflammatory conditions, the ureters are usually extremely tender and pressure produces a strong desire to urinate. All ureteral findings must be verified and amplified by cystoscopic methods.

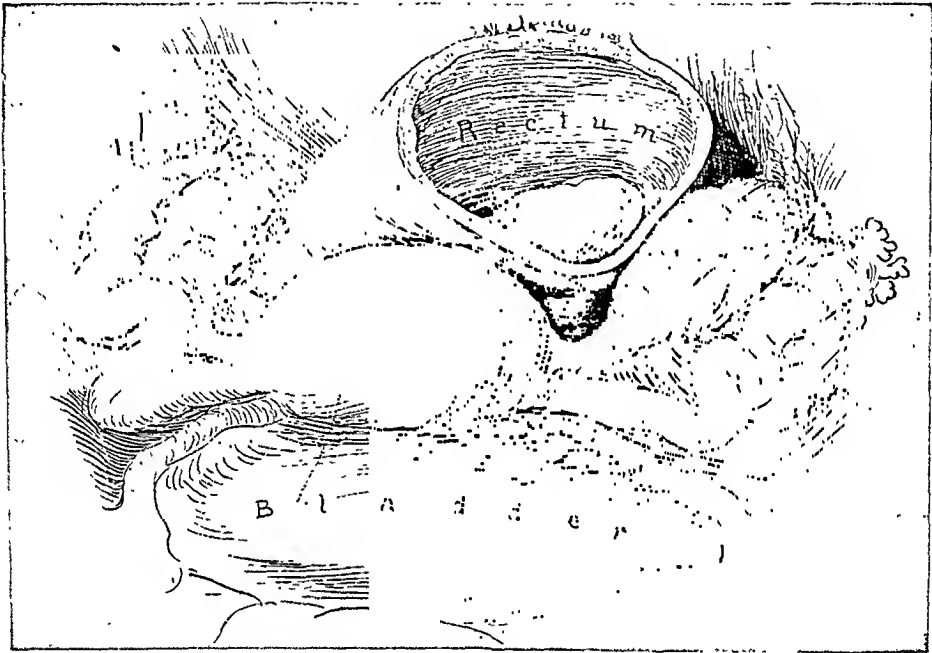


FIG. 65.—RECTUM DISTENDED WITH AIR WITH PATIENT IN KNEE-CHEST POSTURE, AFTER WHICH SHE RETURNS CAREFULLY TO THE DORSAL POSTURE, WHEN SMALL INTESTINES REMAIN IN UPPER ABDOMEN, LEAVING THE RECTUM IN CLOSE CONTACT WITH BROAD LIGAMENTS AND FACILITATING EXAMINATION.

Examination by Rectum and Abdominal Walls.—It is best to empty the bowel thoroughly before examining by the rectum. An important step is the introduction of the finger up beyond the vaginal portion of the bowel and through the “third sphincter” behind the cervix into that part of the bowel which appears to ascend more vertically. This affords a wider reach in the manipulations. A retroflexed fundus is always outlined with marvelous distinctness by the rectal touch cooperating with the abdominal hand pressing down through the superior strait. The crucial point is the recognition of the angle between cervix and fundus, associated with the absence of any fundus in front. The ovaries are felt laterally upon making combined pressure as in examining *per vaginam*. If the ovary is not at once found, its best guide is the utero-ovarian ligament on the posterior surface of the broad ligament just

below the cornu uteri, which is followed out to the ovary. Care must be taken not to press too hard on the bowel wall, to avoid rupture.

Examination by Rectum and Abdomen with Atmospheric Distention of Rectum.—When the ordinary recto-abdominal bimanual examination is impeded by coils of small intestines filling the posterior pelvis, the difficulty may be removed by evacuating rectum and bladder and putting the patient in the knee-chest posture and letting air into the rectum so that the bowel balloons out and applies itself to the sacral hollow and the posterior surfaces of the uterus and the left broad ligament, as the small intestines drop into the upper abdomen. The patient then returns slowly to the dorsal posture, keeping the

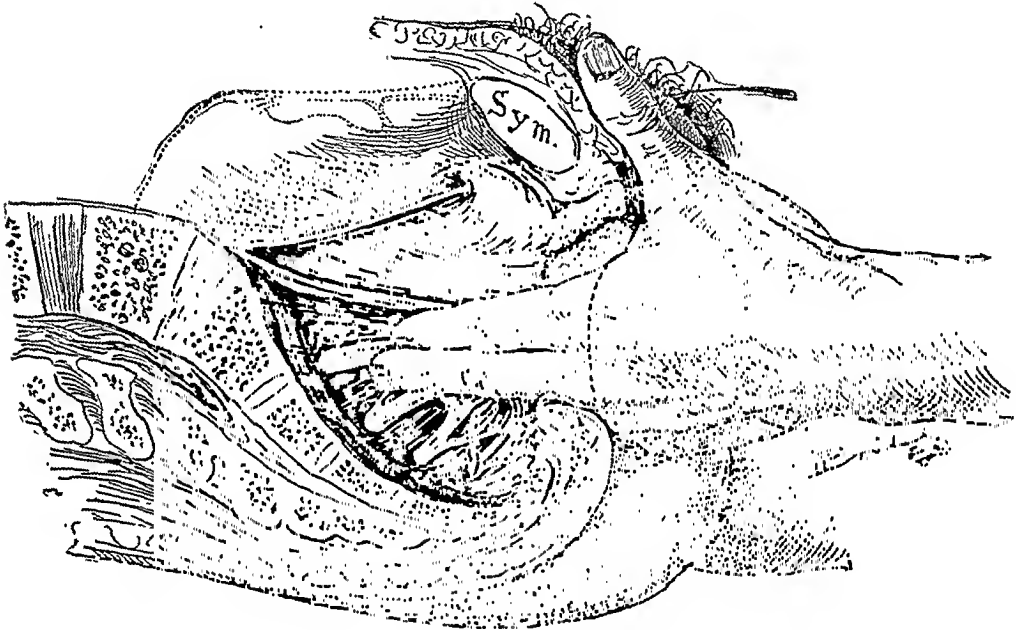


FIG. 66.—PALPATING ROOTS OF SCIATIC NERVE BY RECTUM.

pelvis higher than the rest of the abdomen, Figure 65. The pelvic viscera can now be felt with startling distinctness as the rectal finger enters the large air cavity, the opening from the ampulla into the upper bowel is readily found, and the posterior surface of the uterus, tubes, and ovaries felt as though skeletonized with even their minuter details—fissures, elevations, and variations in consistence—revealed.

The roots of the sciatic nerve can also be palpated by the rectum, Figure 66, sometimes revealing the source of an obscure intrapelvic pain previously attributed to an ovarian or a uterine origin or discovering an intrapelvic sciatica. If the patient is conscious, a cry of pain is elicited when the fingers are drawn over the tender cords.

Examination with Retroposed Uterus.—The abdominal hand presses down behind the symphysis pubis and catches the fundus, while the other hand elevates it through the anterior vaginal wall and shoots it backwards. The fundus thus brought within the grasp of the external hand is pushed back into the

sacral hollow. Continuing the pressure on the anterior face of the uterus with the abdominal hand, the vaginal finger is hooked behind the cervix and rotates it upward. The vaginal finger now withdrawn is inserted high up in the rectum and through the sphincterlike orifice between the uterosacral ligaments where the whole posterior and anterior surfaces of the uterus and the broad ligaments, including ovaries and tubes, can be palpated minutely.

Examination with Uterus Pulled Down toward Vaginal Outlet.—In this method, the uterus is acted upon in three directions at once. The cervix is grasped with a tenaculum forceps and the uterus drawn well down toward the vaginal outlet and so made more accessible. An assistant now takes the forceps while the examiner makes a thorough bimanual examination of the displaced organ by rectum and abdomen. One must not use this procedure in pelvic inflammatory conditions.

Examination of Anterior Surface of Uterus through Rectum.—The uterus is displaced as just described and thrown into a marked retroflexion by hooking the index finger in the rectum over the fundus and gently toppling it over backwards and exposing the anterior wall to touch. After a displacement examination, the uterus should be carefully returned to its normal position by reversing the manipulations.

Uterine Sound in Diagnosis.—The sound, Figure 67, came into the hands of our forefathers as a welcome adjuvant to enable them to differentiate between ante- and retroflexions as well as to “redress” the uterus by rotating the sound. As they were often unable to distinguish pelvic inflammatory conditions, serious accidents sometimes followed such manipulations and in consequence the sound long fell into general disrepute. It has in time, however, become rehabilitated and is of considerable use in determining the depth of the uterine cavity, any extremely sensitive condition of the mucosa, a liability to bleed after slight trauma, the presence of a tumor in the uterine cavity, and the thickness of the uterine wall as palpated through the rectum and

abdominal wall with the sound *in situ*. Unfortunately, too, especially after abortion, it sometimes discovers the extreme softness of the uterine wall by passing right through it up to its very hilt when the point can be felt plainly under the abdominal wall or even up near the umbilicus!

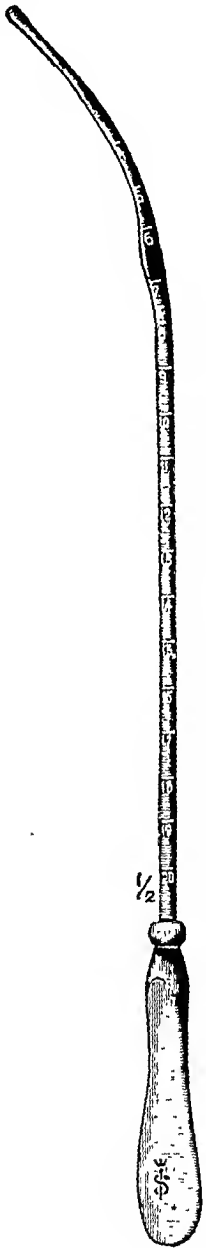


FIG. 67.—UTERINE SOUND.

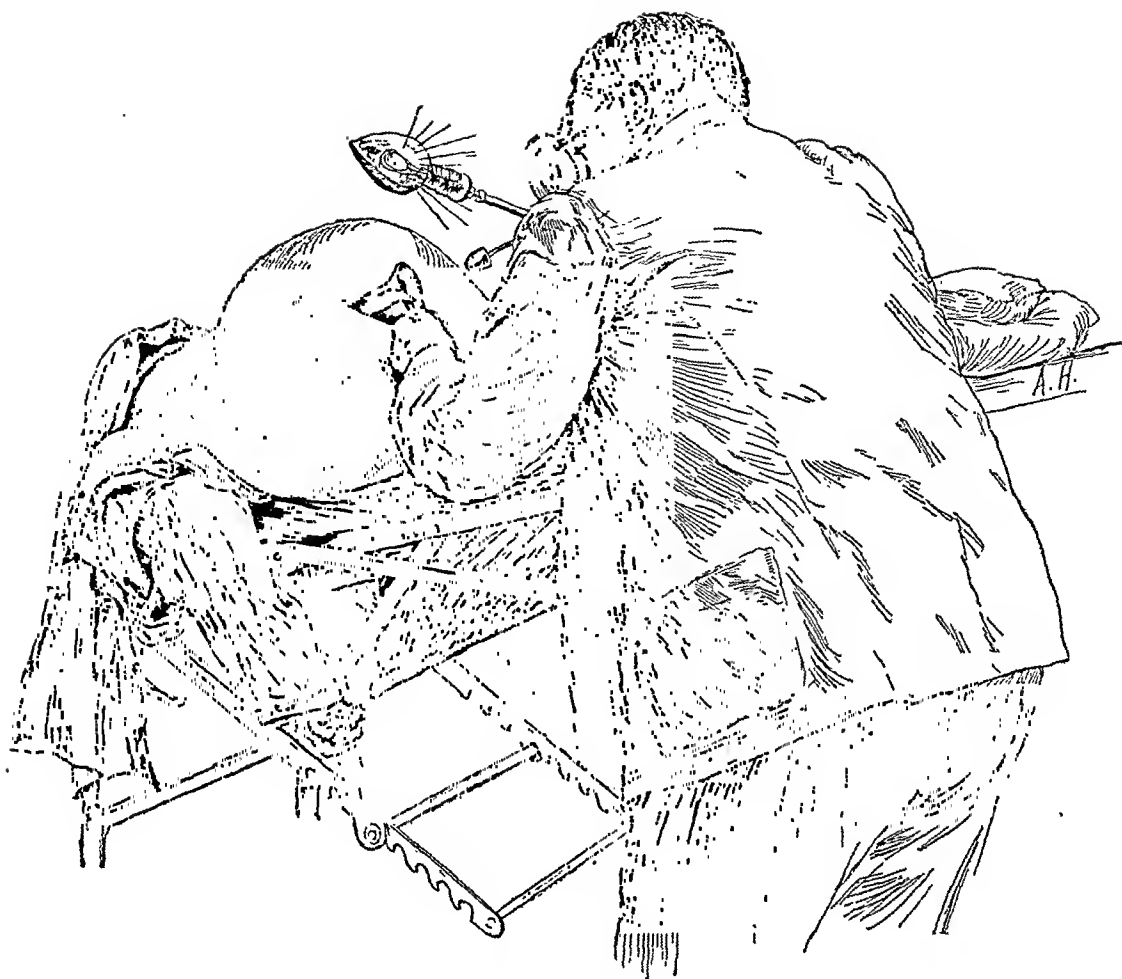


FIG. 68.—INTRODUCING CYLINDRICAL METAL SPECULUM WITH STOUT HANDLE FOR EXAMINATION AND TREATMENTS IN SIMS POSTURE.

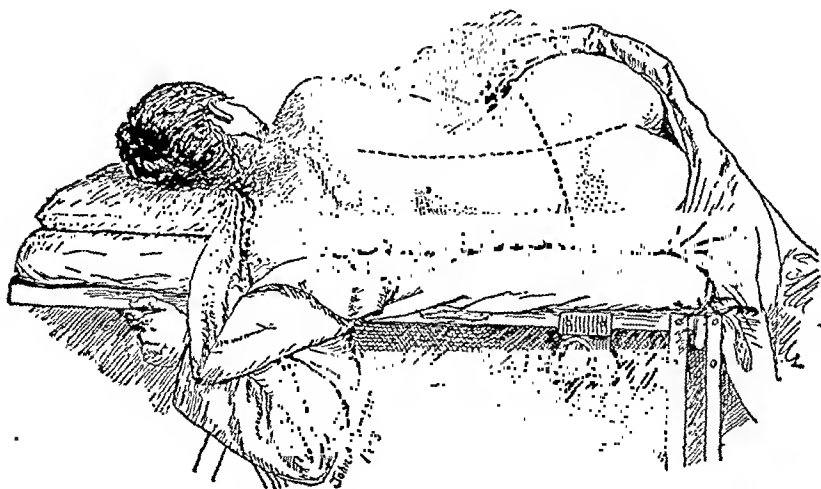


FIG. 69.—SIMS POSTURE.

Showing position of legs, chest, and pelvis, especially inclination of pelvis by which viscera are poured into abdomen.

SIMS POSTURE

The Sims posture, used by J. Marion Sims and by Thomas A. Emmet in their pioneer vesicovaginal fistula work, has pretty generally dropped out of use, and the Sims speculum devised for this purpose, Figure 68, is more used as a retractor of the posterior vaginal wall in operative work on the upper and anterior vagina, taking the place in our country of G. Simon's speculum in Germany. The position of the patient is left semiprone with elevated hips, the pelvis, as it were, pitching its contents out on to the table. The speculum is introduced and the posterior vaginal wall retracted, and air at once distends the vagina which in all its parts becomes visible and easily accessible, Figure 69.

KNEE-CHEST POSTURE

An examination in the knee-chest posture, Figure 70, is best of all to expose every part of the vagina and the cervix and is especially helpful in pinching off suspicious tissue and in applying treatments to the inflamed

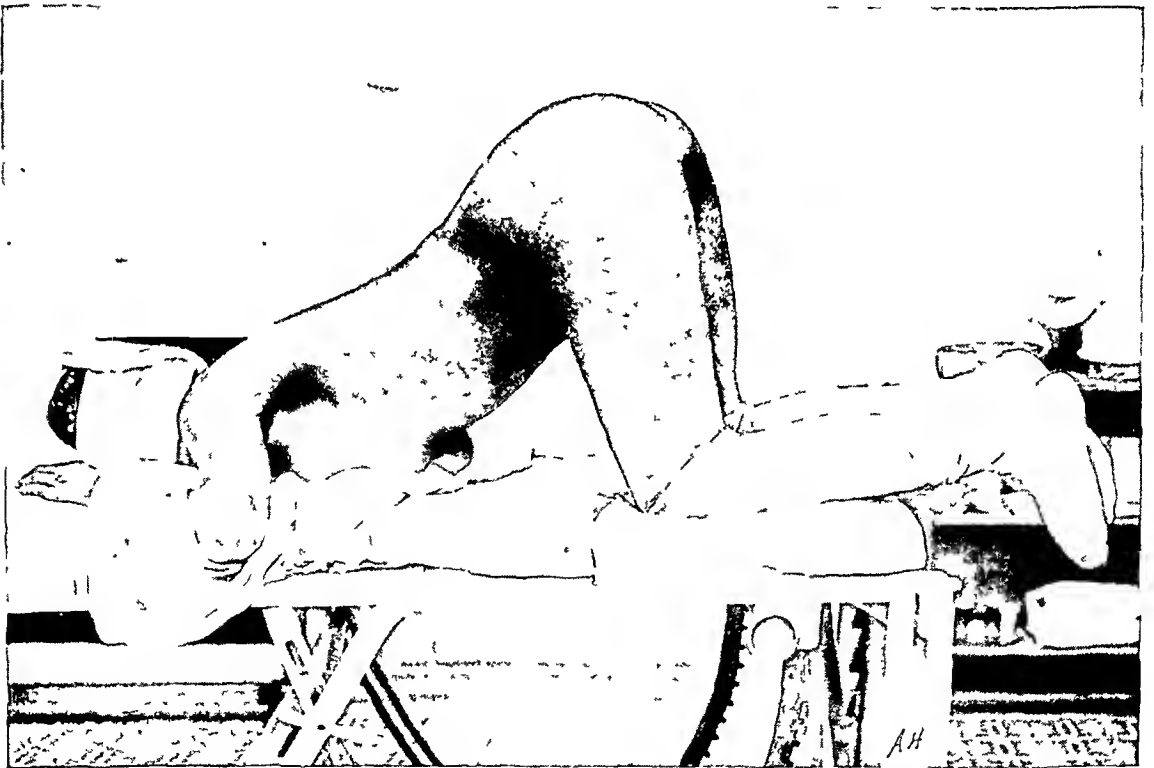


FIG. 70.—KNEE-CHEST POSTURE, GIVING PERFECT EXPOSURE IN EXAMINING ANY HOLLOW PELVIC VISCERA, RECTUM, VAGINA, OR BLADDER.

Note approximation of chest to table, spreading out of elbows, and direction of face to one side, as well as slight incurvation of back. Patient should be at rest and feel well supported in this posture. Most cases do well with thighs at angle of about 65 degrees to body as shown. In other cases a better exposure is secured when thighs are vertical and angle about 50 degrees, while in a few others relaxation is best when thighs are drawn up a little under abdomen and angle is about 40 degrees.



FIG. 71.—EXAMINATION IN KNEE-CHEST POSTURE SHOWING METHOD OF LIFTING UP GLUTEALS AND POSTERIOR VAGINAL WALL, THUS LETTING AIR INTO VAGINA FOR INTRODUCTION OF SPECULUM OR EXAMINATION OF BLADDER.

vaginal walls, as the rugæ are thus all smoothed out, leaving a broad, smooth surface. A good way to let air into the vagina before introducing the speculum is shown in Figure 71. The examination is best made by means of the Kelly conical metal speculum, Figure 73, with a large handle, exposing all parts and protecting the vulvar orifice as the treatments are given.

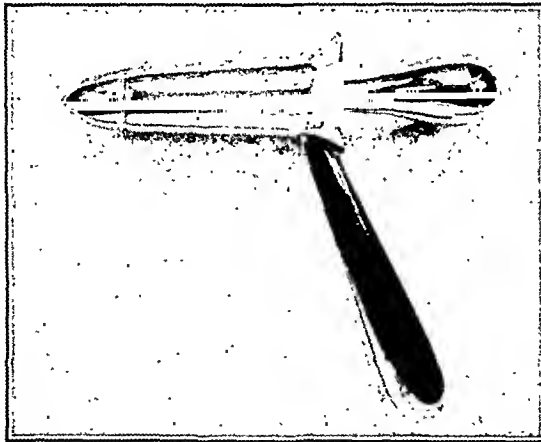


FIG. 72.—KELLY CONICAL METAL SPECULUM FOR VAGINAL EXAMINATION AND TREATMENT.

EXAMINATION OF CHILDREN AND YOUNG GIRLS

For a vaginitis or an intrapelvic infection or a neoplasm, the examination of children and young girls is best made either by putting the patient in the

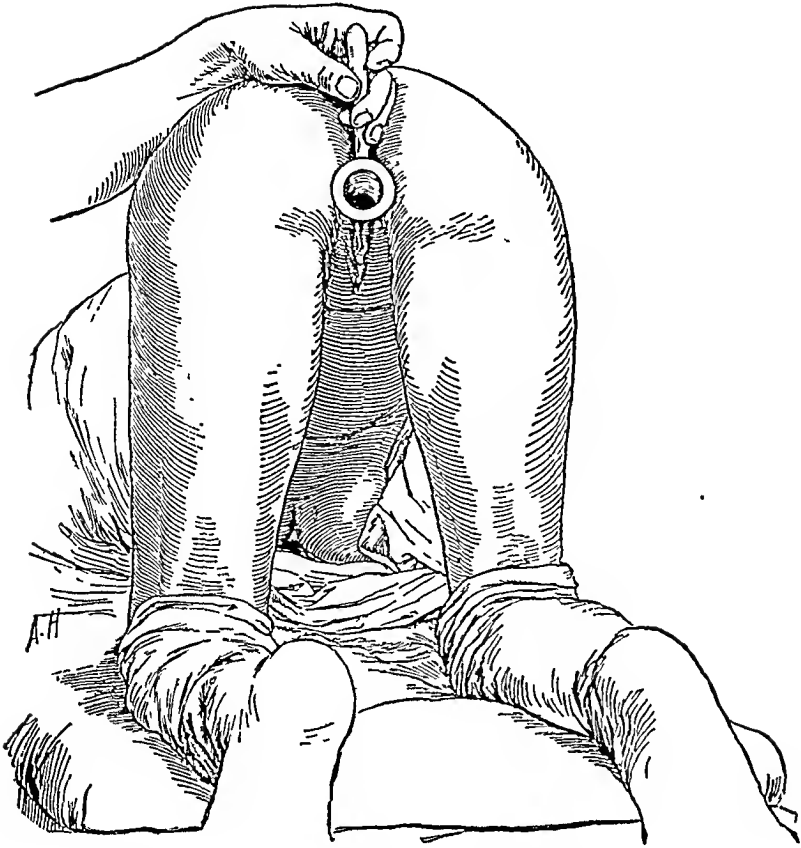


FIG. 73.—EXAMINATION OF VAGINA, VAGINAL VAULT, AND CERVIX IN KNEE-CHEST POSTURE WITH KELLY CYLINDRICAL METAL SPECULUM HAVING A STOUT HANDLE.

knee-chest posture and introducing a small speculum (vesical, 1 centimeter in diameter), Figure 74, through the hymen which is not ruptured by the act and then inspecting with a reflected light, or by making a combined rectal and abdominal examination, Figure 75. The diminished size of the pelvis makes the exploration of infantile or puerile organs relatively easy. For the first examination, it is usually necessary to secure complete relaxation by the inhalation of a few drops of chloroform.

EXAMINATION OF THE RECTUM

A rectal examination is as important as the more strictly gynecological and ought not to be omitted both in the interest of a differential diagnosis as well as to determine the extension of disease from rectum to vagina or vice versa, not forgetting the occasional referred pains so often noted by the older writers, especially in painful fissure of the rectum.

The common diseases to be noted here are hemorrhoids, fissure, fistula, polyp, adenocarcinoma (always confused with hemorrhoids at first by the patient), compression of the rectum by periuterine deposits, and stricture with ulceration so often found in luetic patients.

Occasionally it is well to make the examination without special preparation

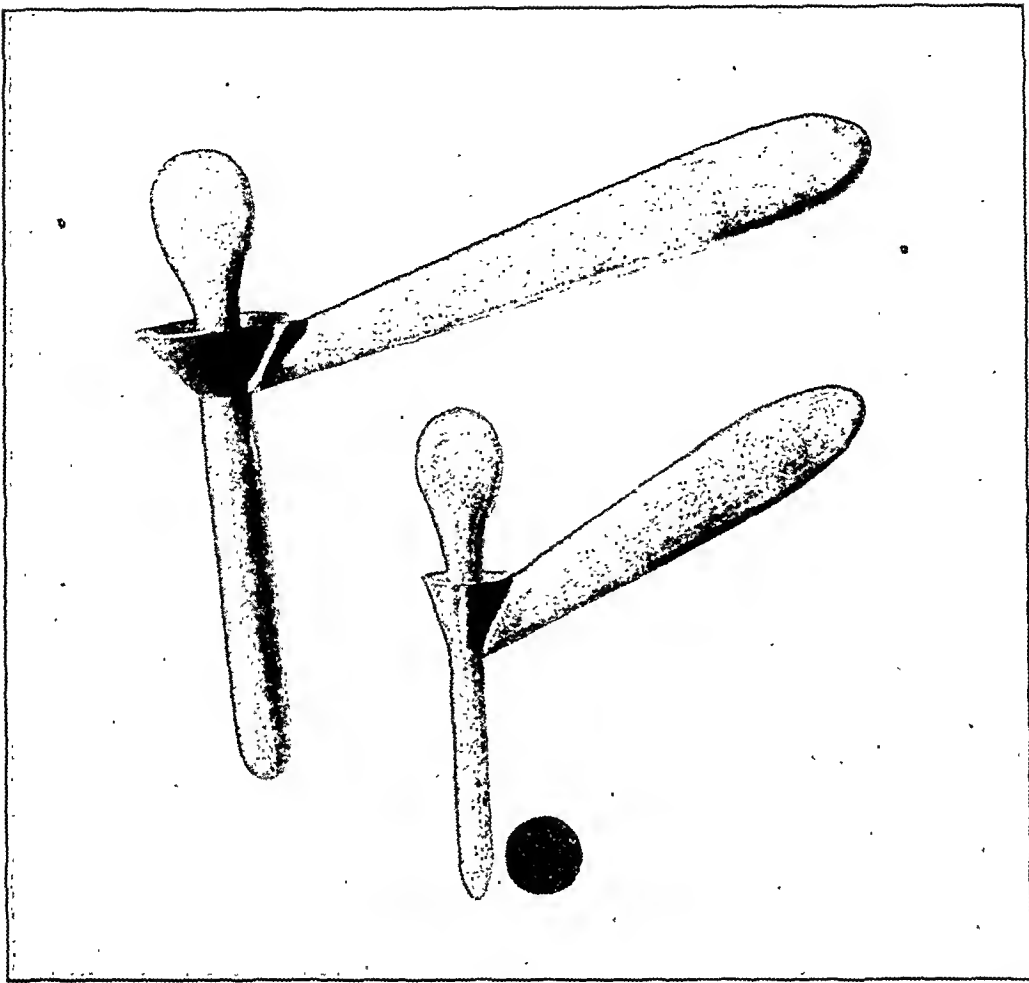


FIG. 74.—SPECULA FOR EXAMINATION WITH INTACT HYMEN, ESPECIALLY IN YOUNG WOMEN AND CHILDREN.

The size of the lumen of the smaller speculum is shown by the black spot.



FIG. 75.—EXAMINATION OF A CHILD ABOUT SIX, SHOWING FACILITY WITH WHICH ENTIRE PELVIS CAN BE PALPATED BY BIMANUAL RECTAL AND ABDOMINAL EXAMINATION, OWING TO RELATIVELY LARGE SIZE OF EXAMINING HAND.

on the part of the patient, when the physician may better judge the habitual state of the bowel, but for thoroughness the lower bowel must be empty. Anesthesia is rarely necessary. There are two methods: by palpation and by inspection.

Palpation.—Palpation of the rectum begins in the course of the vaginal examination when the finger rolls the flattened cord of the bowel from side to side through the posterior vaginal wall or notes the presence of a fecal mass leading to an inquiry as to the habits in evacuating the bowel, or again feels



FIG. 76.—METHOD OF INTRODUCING LONG RECTAL SPECULUM TO EXAMINE ENTIRE LENGTH OF LOWER BOWEL.

a scybalous mass higher up which is often misleadingly tender on pressure but by dint of gentle persistence can be indented. Direct palpation after a slow careful induction of the finger into the bowel reveals alterations in sensitiveness and consistency in the lower bowel, the ampulla, and the rectum to from 8 to 10 centimeters above the anal orifice. This method has its most fruitful field in cancer of the lower bowel which can always be detected if within reach. The findings can then always be confirmed by an examination through the posterior vaginal wall. Palpation will also sometimes reveal the site of a fistula which can best be studied on its vaginal side as it is pushed forward by the index finger.

The most valuable and revelatory method is inspection.

Inspection.—Under inspection the whole mucous surface of the lower bowel is visible from its external orifice up to the sigmoid flexure, while vessels, alterations in color or unevenness of surface and deposits, with changes in caliber and points of fixation and the pulsations of the left common iliac artery, are at once evident. The bowel should be emptied and the patient placed in the knee-chest posture with thighs vertical and back well curved in, head turned to one side and chest as near the table as possible, without corsets



FIG. 77.—INSPECTION OF BOWEL WITH SIMPLE HEAD MIRROR USING REFLECTED ELECTRIC LIGHT.

or any garment constricting the abdomen, Figure 76. A cylindrical speculum 10 centimeters long and 2 centimeters in diameter is introduced, the obturator withdrawn when the air rushes in, and the bowel inspected by reflected light with a head mirror, Figure 77. Specula of varying calibers and lengths are necessary in the long run.

The purpose of the inspection is to note all alterations from the normal appearance of the bowel, such as patches of congestion, mucus lying on the surface, ulceration, and polypi, and from time to time a carcinoma where the patient thought she had hemorrhoids. Strictures are commonly found in connection with pelvic tumors, narrowing the lumen.

Pelvic peritonitis, especially when due to ovarian or tubal abscesses, is liable to cause a stricture of the rectum at any point from the brim of the pelvis down to the ampulla. I have seen the rectum choked by a large tubal

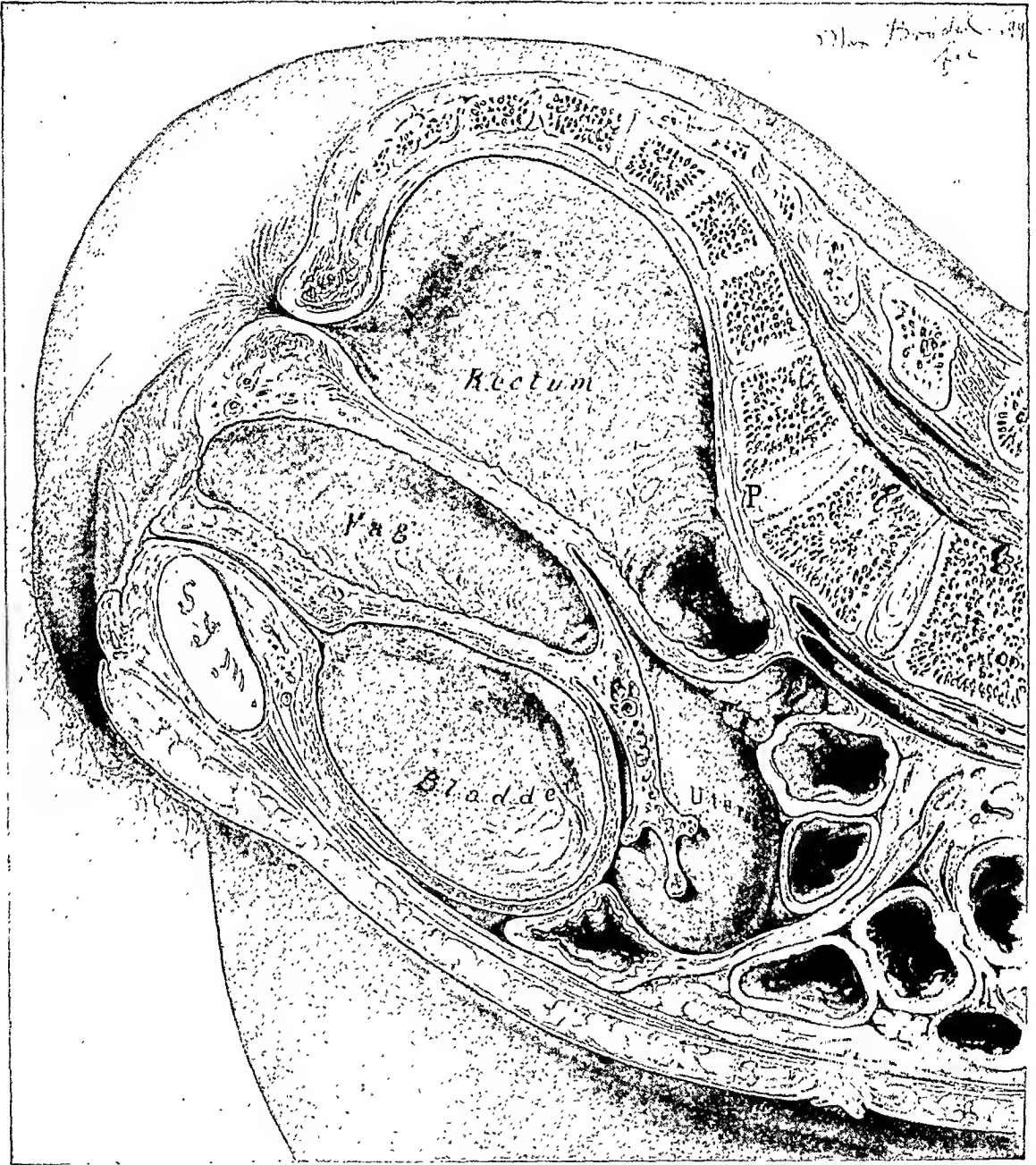


FIG. 78.—KNEE-CHEST POSTURE.

Rectum, bladder, and vagina distended by posture. Vagina does not reach its maximum distension while rectum and bladder are filled with air. It is easy to see how readily each of the pelvic viscera can be inspected through a tubular speculum of suitable size.

abscess with a constriction extending from the ampulla to the upper pelvis, and the bowel greatly distended above it with an opening from the sac into the rectum. Again, in a dense inflammatory mass with abscesses on both sides

extirpated with the uterus, there was a tight stricture of the bowel just below the sacral promontory.

A fistulous orifice foreshortened in the bowel is overlooked until the plane of the mucosa is changed by making pressure on the mucosa.

A short speculum best exposes the ampulla and the sphincter area. It is curious and inexplicable why some patients make so much fuss over a simple rectal examination.

The facility with which the posturally air-distended vagina, rectum, and bladder can be investigated visually is shown in Figure 78.

The examiner ought not to confine himself to one method of examining but should supplement one with another. The commonest combination is to examine first in the dorsal posture by inspection, touch, bimanually, vaginal, rectal, and specular; then to put the patient in the knee-chest posture and look into the vagina, rectum, and bladder with the tubular speculum. It is often well before reaching a deliberate conclusion to make a second investigation as though no previous one had been made.

I frequently, in from 20 to 30 per cent of my patients, find it necessary to review and complete the office examination under an anesthetic in order to substitute complete relaxation for resistance and to eliminate all pain. Diagnoses made on the office table are often corrected in this way and serious blunders avoided.

SEAT OF PAIN

Many of our patients come simply complaining of pain, and one of the important aims of the gynecological examination must be to discover just which organ is tender. For example, when the pain is in the left pelvis, if it is likewise felt when the ovary is squeezed, its seat will in all probability have been discovered. A pain felt on the right side when pressure is made on the ovary or tube will obviate the mistake of incriminating and removing an innocent appendix. I have found so many cases of more or less indeterminate right-sided pain due to a displaced kidney or a kinked or strictured ureter that I have for many years been in the habit of passing in a renal catheter and then injecting enough bland fluid to induce a mild renal colic, clearly differentiating between the kidney and some other suspected organ. A tenderness on pressure along the ureters or at a spot at the vaginal vault laterally associated with a desire to urinate calls for a more complete examination of the urinary function. Pelvic inflammatory disease is associated with marked tenderness out in the posterior lateral pelvis and is usually accompanied by a resistance and an obvious swelling.

Women also often complain of pain in the pelvis for which no objective basis whatever can be found. For example, the least pressure in the direction of the uterus or in the ovarian regions may elicit lively complaints of pain although the organs appear perfectly normal. Persistent palpation, however,

while the attention is diverted, often serves to show that there is no gross lesion. As the patient gains confidence in her physician, his assurances will sometimes minimize the complaints which are more commonly found in high-strung nervous women. It is a mistake always to begin a course of local treatments in this group; the plain truth is the best medicine. If there is any lingering doubt, it must be cleared up by examining under anesthesia.

EXAMINATION UNDER ANESTHESIA

One of the great contributions of the present generation is the realization of the value of a frequent recourse to nitrous oxid gas, or gas and ether anesthesia to the point of complete relaxation to clear up the diagnosis in any puzzling intrapelvic disease. Weeks, months, or even years of useless palliative measures would often be saved if the patient were anesthetized and examined at the very outset by a competent specialist. The purpose of the anesthesia is to obviate all resistance of the patient by inducing a complete relaxation of the abdominal muscles and eliminating all sensation of pain. Such an examination can be made with a thoroughness impossible in any other way; the uterus can be drawn down, judicious traction made on adhesions, the perineum deeply invaginated, and inflamed tubes and ovaries handled, and all without hurry.

I, therefore, resort to an anesthetic: (a) Where a doubt remains after the bimanual examination; (b) where there is much unexplained tenderness; (c) where a patient has had treatment for a long time at other hands without improvement before coming to the specialist who is inclined to reverse the previous diagnosis; (d) in pelvic peritonitis involving one or both ovaries or tubes, without producing any gross tumor, to determine the extent of the disease, and (e) almost always in unmarried women.

With the increasing use of gas anesthesia (nitrous oxid plus oxygen) and with long experience, the procedure has become greatly simplified. If the patient has not had her breakfast, I often send her at once to the operating room, have the bowel emptied if full, and proceed at my convenience between seeing ambulatory patients in the office. As a rule complete anesthesia is necessary, but not infrequently it is possible in the preliminary stages to catch the few seconds of relaxation necessary to sweep the finger in the rectum completely over the intrapelvic organs, outlining uterus and ovaries and excluding any fixation or enlargement of the uterine tubes. Such patients usually return home the same day. The various examinations are made as already described.

EXAMINATION OF THE ABDOMINAL ORGANS

Let the beginner note that puzzling and difficult as our methods of investigation may seem at first, practice and experience in time make them a sort of second nature as the trained senses become more acute. This status is reached

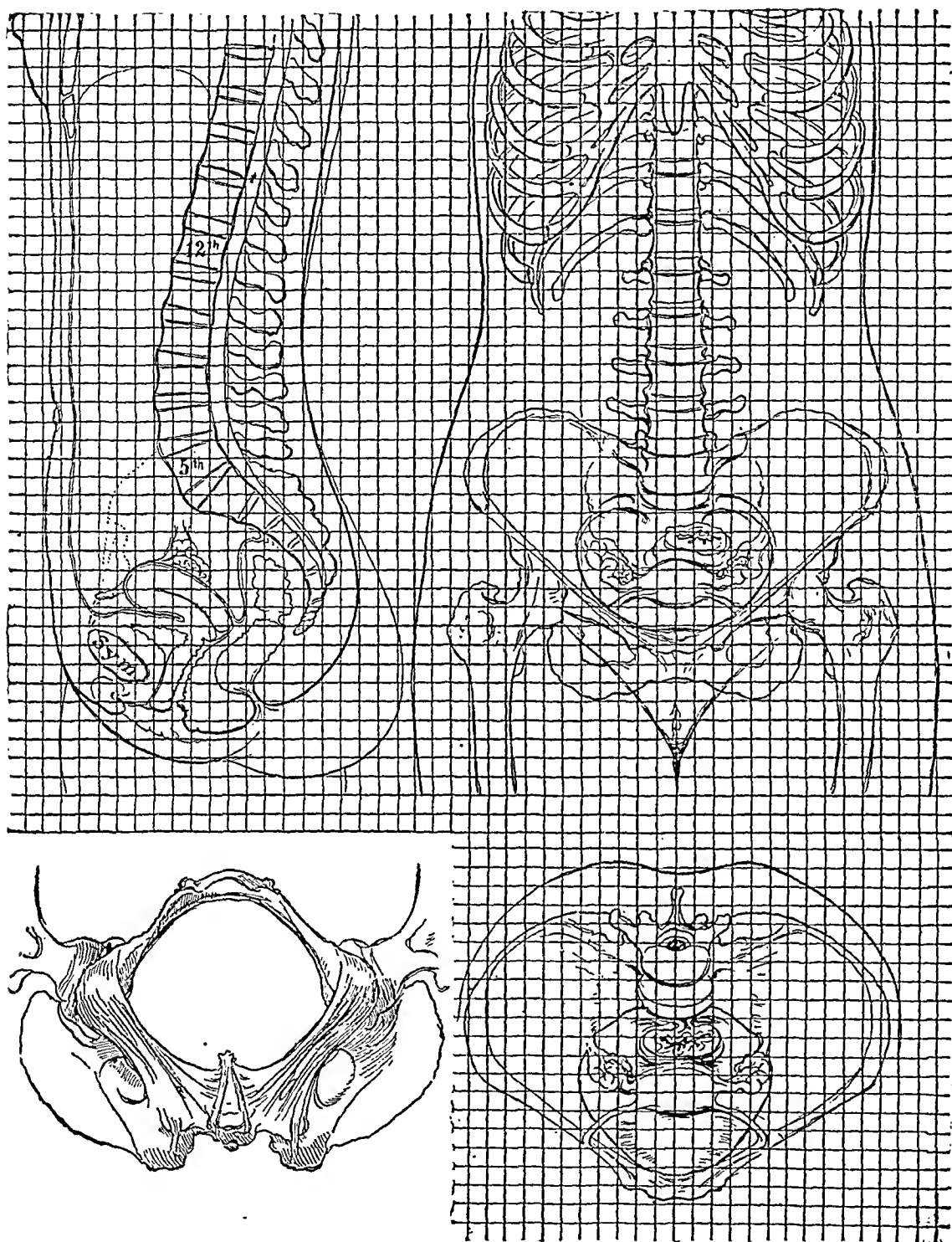


FIG. 79.—FOUR CARDINAL PROJECTIONS OF ABDOMEN AND PELVIS, REDUCED ON SAME SCALE.

Any point in abdomen can be located by following parallel lines in the three projections. Lower diagrams are viewed perpendicularly to the plane of the superior strait.

more quickly if every case is thoroughly examined and every opportunity to learn is embraced.

Note the general condition of the abdomen—whether fat, well-nourished, or scaphoid; if the patient is stout, lift up a fold of the fat wall and measure its



Fig. 80.—LEFT FIGURE SHOWS IN OUTLINE, SITUATED ABOUT PERIPHERY, THE VARIOUS IMPORTANT ABDOMINAL ORGANS FROM WHICH TUMORS MAY ARISE. IN RIGHT FIGURE, ARROWS INDICATE DIRECTIONS TAKEN BY THESE TUMORS FROM PERIPHERY TOWARD CENTER, WHERE RESISTANCE IS LEAST.

thickness. The whole abdominal zone must be examined, Figures 79 and 80, for unduly tender spots and areas of resistance. My preference is to palpate first the parts not under suspicion and then to concentrate on the area where the disease is more likely to lie, dissipating from the patient's mind the notion that she is going to be treated roughly and hurt and thus winning her confidence in this often the initial step in the examination.

The stomach, pancreas, and spleen are touched with a light, penetrating pressure, then the whole colic region in the periphery and the umbilical zone, and with increasing depth the right loin is palpated bimanually to determine the position of the kidney. The patient takes a deep breath to bring it as low as possible and just as she expires, the fingers of both hands are brought together, either meeting above the upper pole and detaining it below or catching the lower pole as it slips back under the ribs in a moderate displacement. If the history points to the kidney, and it is not found in displacement, it can sometimes be brought down by examining in the erect posture and after walking about. If she has had attacks of pain of an uncertain nature, it will be a great help to see and examine her during such an attack. Intermittent renal colics and ureteral strictures are identified by catheterizing the ureter and injecting a bland fluid, distending the kidney, when the patient often cries out dramatically, "That's the pain!" In visceroptosis, both kidneys often drop with stomach, intestines, and liver.

The right iliac fossa must be studied with care as the question of appendicitis is so constantly raised and often not easy to settle. George Edebohls used to be confident that he could detect the appendix and roll it under his fingers, a great help in deciding whether or not it was involved; his followers are not willing to make such a claim.

The right side of the abdomen offers a Pandora's box of possible troubles needing to be distinguished, constantly confused, and giving rise to many futile operations. Enumerated from above down, they are:

- Gall-stones or cholecystitis
- Kidney stones, pyelitis, and displaced kidney
- A loaded and mobile cecum
- Appendicitis
- Referred pain from pneumonia
- Acute infectious diseases in children
- Intestinal obstruction
- Psoas abscess
- Lead poisoning
- Tabetic crises
- A lax sacro-iliac joint
- Ureteral stricture and stone with dilatation
- Tubal and ovarian tumors and inflammation

Catheterization and an injection distending the renal pelvis clear up the kidney and ureter. Purgation and a bismuth meal with x-ray photographs remove the bowel from the category. With the chain thus broken in the middle, it becomes easier to distinguish between some form of pelvic disease and a gall-bladder affection.

When the appendix remains in serious doubt, the operator is fortunate if he discovers some other valid reason for an abdominal operation when the ap-

pendix can be inspected directly and removed.

Of sacro-iliac luxation, I speak more fully elsewhere.

Inspection. — Inspection of the abdomen reveals differences from the normal in contour, absence of normal movements as in breathing, and color, and takes note of drawn knees in peritonitis.

In tumors, ovarian or fibroid, the lower abdominal wall is pushed forward and held splinted while the wall above this area moves freely with respiration. This is well shown in the hazy breathing line in a photograph taken from the side. The cylindrical abdomen of an ascites in a nullipara is obvious as well as the flaccid walls bellying out at the sides

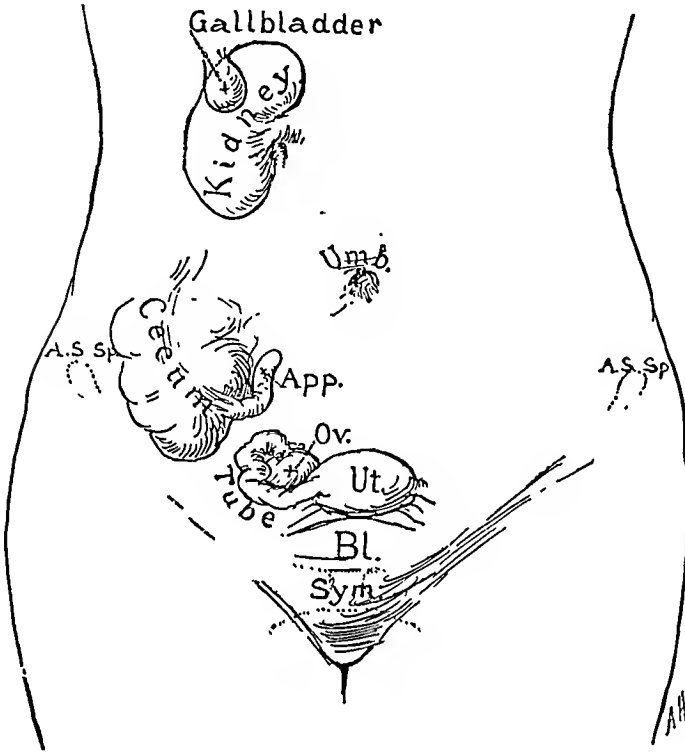


FIG. 81.—ORGANS ON RIGHT, WHERE AFFECTIONS ARE LIABLE TO BE CONFUSED.

By careful rectal palpation, ovary and uterine tubes are felt; by careful palpation in the right iliac fossa a diseased appendix can be reached; right kidney can be examined with unerring certainty by injecting its pelvis through ureter.

with an accumulated fluid within. A blue umbilicus may indicate a ruptured extra-uterine pregnancy, and, rarely, a yellowish or greenish one a ruptured gall-bladder. Distended superficial veins are a sign of interference with the circulation within. Drawn-up limbs characterize peritonitis localized or general.

When there is some progressive trouble within, measurements should be made to show changes in the size of the abdomen. Mensuration does away with the vague terms, "a small tumor," "a large tumor," "an enormous tumor," or as one of my friends once wrote, "a very, very large tumor!"

The following are the usual measurements when there is a tumor of size:

- Circumference of the abdomen at the umbilicus or below it
- Distance from back to highest part of tumor

Distance from symphysis pubis to top of tumor

Distance from ensiform to top of tumor

Note also whether the tumor lies more on one side than the other and any nodules.

Marked departures from the normal occur within the limits of health, due to gaseous distention or an accumulation of fat in omentum and abdominal walls. Tympany is symmetrical from the uniform expansion of the mobile intestines, the general appearance often not differing markedly from an encysted tumor. The distinction is easily made by percussion and noting the general

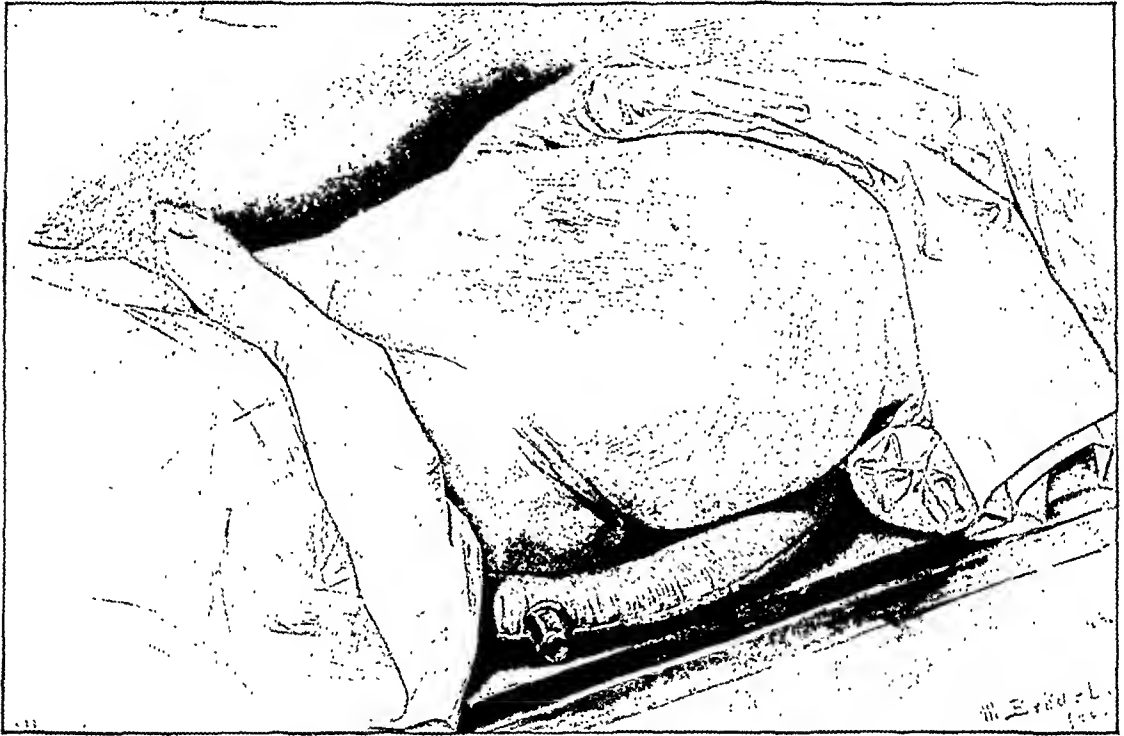


FIG. 82.—CHARACTERISTIC FORM OF FLACCID ABDOMEN WITH ASCITES.

Fluid has gravitated down into flanks, and anterior abdominal wall in median line almost rests on vertebræ.

tympany, the absence of positive signs of the tumor, and the disappearance of the tympany with a free evacuation, as well as by its general tendency to vary in size. A fatty abdominal wall is often characterized by a transverse pendulous fold, hanging down over the mons and even reaching to the knees. It is frequently a great relief to the carrier of such a burden, as well as a great convenience to the surgeon doing an abdominal operation, if such a mass is excised; if removed, it never returns (Chapter XXII). A small abdominal tumor may be most difficult to detect in a fat nullipara.

Some forty years ago, I was called by George Guthrie of Wilkesbarre, Pennsylvania, to operate upon a woman long celebrated for her great weight. The operation had to be done in her home, and Guthrie believed she would

not consent to be detained in bed or restrained in any way. She had a marked ascites and had been tapped by a hollow instrument, like a sword, made for the purpose, which was plunged through the thick abdominal wall. I escaped from my serious predicament by making an incision through the umbilicus where the skin is always thin and evacuating the fluid and exploring the abdomen to discover a few insignificant myomata. She got out of bed the following day without ill sequelæ!

Pelvic tumors pushing up through the superior strait are marked out by an area of resistance surrounded by a corona of resonance on three sides as outlined by palpation and percussion. It then remains by a bimanual examination to differentiate between an ovarian and a uterine tumor by tracing the enlargement of a uterine growth as more or less firm and in direct continuity

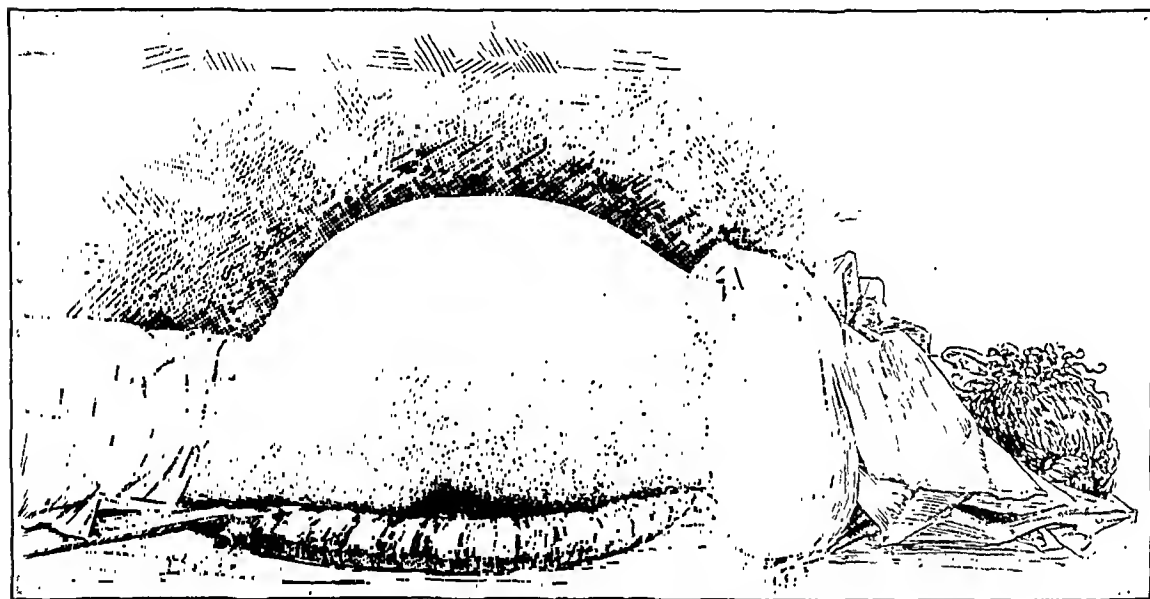


FIG. 83.—CYLINDRICAL FLATTENED ABDOMEN CHARACTERISTIC OF ASCITES.

with the cervix or as in ovarian tumors inclined to be lateral, indentable, and fluctuant, or varying in consistency in its several areas. Any impulse given a uterine tumor above is at once conveyed to the pelvic finger touching the cervix, particularly slight rapid vibratory movements. If the cervix is grasped with a tenaculum forceps and pulled down, while the hand above pulls the tumor up into the abdomen, the forceps at once begins to disappear *pari passu* upwards into the vagina in a uterine growth. This does not occur if it is ovarian.

The abdomen of the ascitic is often strikingly characteristic, either flaccid and "schwappig," Figure 82, or cylindrical, Figure 83. The resonance is median as the patient lies on her back, and the dulness lateral; this varies with any change of posture. A difficulty sometimes arises in fibroids or malignant disease of an ovary with an ascites of varying degree. Here one must expect to find the well-defined lateral dulness unless the fluid is sufficient to

displace the abdominal wall from the colon. An abdomen which is tense from a large ascitic accumulation everywhere pushing the walls out away from the intestines often puzzles a beginner. Occasionally a long hypodermic needle solves the difficulty as the syringe fills with the ascitic fluid which should always be examined also for cell elements cast off by a growth. The bulging downwards of Douglas's culdesac may help here.

The possibility of pregnancy must ever be first in the examiner's mind as he proceeds to investigate a pelvic tumor of any sort. It will not, therefore, be amiss to outline here the distinctive marks, observing that there is no gynecologist of experience who has not sometime committed the error of open-

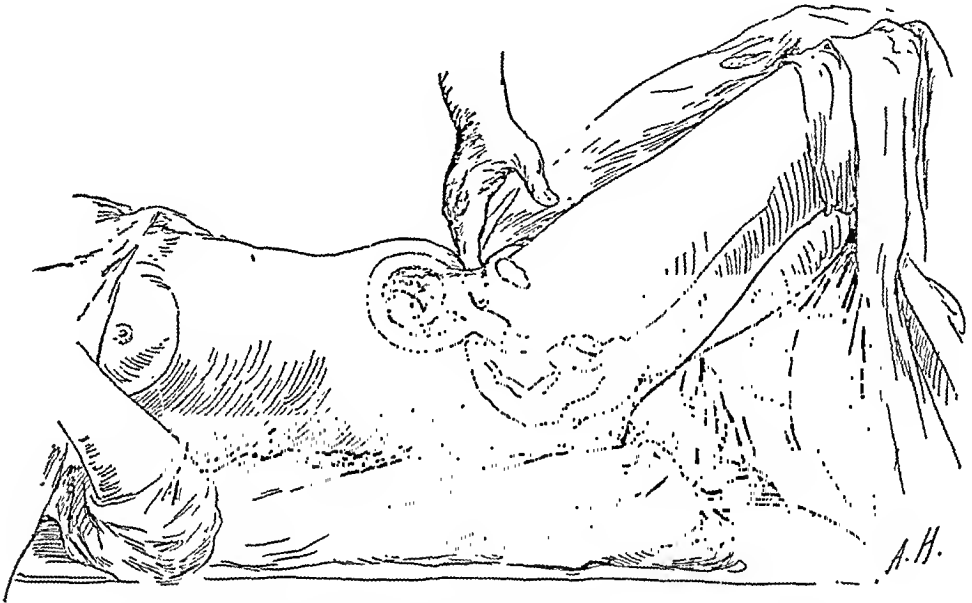


FIG. 84.—EARLY PREGNANCY SHOWING GLOBULAR ENLARGEMENT OF UTERINE BODY.

Cervix often flexible at point under palpation may feel like organ detached from semi-fluctuant mass above.

ing the abdomen and discovering an unsuspected pregnancy, generally complicating some growth.

Formerly, with less experience, egregious blunders were made. The writer recalls an instance in the hospital where he was a resident in the early eighties. A woman with a large fibroid tumor had recently arrived in this country and the day was set by Forbes for the operation. But on that very morning, Jack Mitchell (son of S. Weir) met the expectant surgeon at the hospital door with the greeting, "Doctor, the tumor has been born!"

Now with a proper examination, such a mistake never occurs in the later months. The difficulty is sometimes to decide between an intra-uterine with unusual symptoms and an advanced extra-uterine pregnancy. In an early pregnancy, as a rule, the patient is married, and has amenorrhea supervening a previous regular menstruation, with disturbed stomach. The uterus in the second, third, or fourth month is enlarged, and the body softish, sometimes

feeling as though hinged on to the cervix which may be mistaken for a rather small body, Figure 84. Sometimes the pregnancy is apical, that is to say, in one cornu of the uterus which acts for a time, occasionally well on into the later months, as though the right and the left halves were independent; one side swells and softens while the other feels like a firm hard ridge. I have noted this condition frequently and checked a prospective operation; in one instance I opened the abdomen to discover a right apical pregnancy, closed it, and the patient went to term. Such a condition is suspiciously close to an interstitial pregnancy. Finally, if the patient's condition is serious, the presumption is against a normal pregnancy. If it is not serious, one or two months' delay under close observation will settle the diagnosis in the persistence of the amenorrhea and the enlargement of the "tumor." Under no circumstances should a sound be inserted or the cervix dilated when pregnancy is one of the alternatives. Here, too, we all have erred unwittingly at one time or another, but such errors should be rare.

When the patient leans forward, resting her weight on a nurse and relaxing her abdominal muscles, the examiner, sitting before her or at her side and making counter pressure with one hand over the back while with the other deeply palpating through the lax abdominal walls, can then best feel a displaced kidney.

CHAPTER IV

SUNDRY DIAGNOSTIC AIDS

HOWARD A. KELLY

URINALYSIS

BLOOD EXAMINATIONS

BASAL METABOLISM

MICROSCOPY

In nothing perhaps is the scientific character of gynecology to-day more evident than in the ubiquitous laboratory equipments of every first-class clinic, ready to respond promptly to the queries constantly addressed to it. If the clinic is large, the laboratory should be self-contained, within the institution.

Urinalysis.—No detail in the preparation of a patient for operation is more important than a careful urinary examination. The kidneys are often seriously taxed by anesthesia and operation, making it essential to investigate their status beforehand. A convalescence is often seriously impeded by unsound kidneys; moreover, every pathologist will attest to unsuspected renal lesions found in autopsies. Out of twenty-nine autopsies in my service at the Johns Hopkins Hospital, nineteen showed some kidney lesion. In eight there was a chronic diffuse nephritis; in eight, fatty degeneration and cloudy swelling; in two, the ureter was occluded by a ligature; and in one, there was an atrophy of one kidney. One of the chronic nephritic group had a pyelitis with calcareous incrustation of the papillæ of the pyramids; one of the two with an occluded ureter had a hydronephrosis on the occluded side and a pyonephrosis on the other. I cite these troubles of earlier days, as I am convinced that in some clinics there is still a lack of due discriminating attention to this function. In none was the nephritis far advanced, and in no instance was death apparently attributable directly to this source, although, as shown by S. Flexner in a study of terminal infections, lesions of the kidney impair resistance and make it easy for organisms to enter and usher in a fatal terminus.

A knowledge of the condition of the kidneys is of value that we may refuse sometimes to operate in the presence of an advanced renal lesion; that we may delay an operation in less serious cases until these emunctories are brought into better condition—this applies with especial force to diabetes; that we may in every way avoid taxing the patient's endurance if there is a complicating kidney disease; that we may follow all such with repeated examinations of the urine in their convalescence, avoiding drugs tending to check secretion, while assisting the kidneys by throwing some stress of excretion upon skin and bowels.

In advanced carcinoma, a common cause of death is the impairment of function and the retention of nitrogenous products by the progressive compression of the ureters until at last both are choked off and convulsions cause the exitus.

A fibroid tumor or a large ovarian cyst choking the pelvis often causes a hydro-ureter and hydropelvis which demand prompt attention, in addition to the fortunately rarer accident—the choking off of the urethra with an attendant destructive vesical ischemia.

To avoid leukorrhœal contamination, the urine should be secured by catheterization.

To determine accurately the difference between catheterized and voided urine, I analyzed thirty of each: Nine voided specimens showed albumin, where the catheterized urine from the same patient showed none. In all nine there was a leukorrhœa.

A microscopic examination showing pus is always important. If there are but few pus cells noted in a field, it may be neglected in the absence of anything suggestive in the history, but it must be called to mind again in the event of any postoperative fever. A previous story of cystitis should always be noted as it may recur, when the surgeon can exonerate himself.

Phenolsulphonephthalein in solution, in constant use in clinics all over the country, is injected warm and used as a determinant of the amount of urea excreted. If the urea is low, the color index of the “thalein” is usually also low. The relation between the excretion of the dye and of urea, which appears to be an accidental one, is fortunately almost invariable, making the dye a satisfactory index of the nitrogenous product.

The kidneys are stimulated by giving 300 to 400 c.c. of water about twenty minutes before the injection, and 1 c.c. of the solution containing 6 milligrams of the “thalein” is injected intramuscularly in the lumbar region.

The patient is catheterized and the urine collected in a beaker containing a couple of drops of 25 per cent sodium hydroxid which develops the characteristic red color. This should begin to appear in about ten minutes. A one-hour sample is taken for comparison with a color scale which shows the amount of the dye excreted. Two or three samples are taken. In health, 30 to 50 per cent is returned in the first and 20 to 25 per cent in the second hour. We do not often see the larger amounts cited. This method must be used, however, with some degree of caution, as it depends upon two factors liable to variation: First, the resorption from the tissues likely to be sluggish in the old; second, the kidney function. In differentiating the kidneys, this is the one test of value, but then calls for ureteral in place of vesical catheterization.

In large cystomata and fibroid tumors, I have seen an albuminuria disappear within two weeks after the extirpation. With big double dilated ureters and sometimes a unilateral infection, the removal of a large fibroid is not in reality, as the operator may imagine, for its own sake, but simply to take the pressure from the ureters.

When an operation is done in the presence of any decided renal disability, the operator will diminish the tendency to shock and tax the lessened vitality as little as possible by cutting out all delays, proceeding promptly with his work as soon as the patient is anesthetized, and taking all possible precautions to avoid shock by the external application of heat during the operation and suitable stimulants afterwards, and exposure of the viscera. In such a case, the operator will often do better to use gas, spinal, or local anesthesia.

To illustrate, I had a patient die in the ward without operation, with a pyelonephritis caused by a myomatous uterus choking pelvis and abdomen; I have also seen a pelvic abscess associated with a pyelonephritis of the same side cause death. I recall but one case with an amyloid degeneration of the kidney associated with pelvic suppuration, and that was in a syphilitic; this is no longer the bugbear it was once.

Carcinoma of the cervix in its advanced stages commonly strangles the ureters, producing hydronephrosis and uremic death. Of eight inoperable carcinomas with an autopsy, two had one ureter greatly enlarged with hydronephrosis, and the other showed a great distention of both ureters and kidneys. Five were markedly uremic for days and even weeks before death which came after some days of coma.

I may cite here suggestively a woman of high social position who came to me with an advanced carcinoma of the cervix with extensive edema of both legs and a puffy swollen face, but a clear mind. It was important for family reasons to prolong life, in addition to her own earnest desire, so I catheterized both ureters and left the catheters in, only changing them at considerable intervals. There was an immediate enormous output of urine of high specific gravity in a steady stream, amounting to gallons in a day, literally draining the edema out of her body. She recovered temporarily and was in seemingly good health for a month when she died.

Blood Examinations.—These embrace blood-counts, hemoglobin, serology—including Wassermann tests, chemical blood, urea, nonprotein nitrogen, sugar (glycemia), calcium (Chapter VIII), and thrombin:

Since the introduction of the phthalein test in 1910, another method of far greater precision has been coming into vogue, namely, a determination of the nitrogen content of the blood.

For urea take 2 c.c. of blood; nonprotein nitrogen calls for about 6 c.c.

The urea nitrogen is about 50 per cent of the nonprotein nitrogen in normal cases. Taken singly, one is as valuable an index as the other, but when both are determined, a valuable ratio is secured very helpful in prognosis. The normal amount of urea is 10 to 20 milligrams per cent and the nonprotein nitrogen, 20 to 40 per cent. This allows for the somewhat higher per cent in heavy eaters.

Pari passu with the impairment of the kidney function, the nitrogen content of the blood begins to climb to higher figures, up toward 100, 200, and

over. Uremia and uremic coma threaten when the urea nitrogen ascends to 75 per cent of the total nonprotein nitrogen (NPN). The danger mark for nonprotein nitrogen is 100 and that for urea 75; a patient at or above this stage is approaching uremia and this may be due either to primary disease of the kidneys or to some obstruction in the urinary tract.

The interpretation of the Wassermann reaction has ever been the subject of much debate. If only it were always 100 per cent positive or 100 per cent negative, all our difficulties would vanish; it is the variation in reaction under apparently identical conditions that leads to debate.

It is most important in interpreting the Wassermann to remember that the strength of the reaction varies with the immune bodies present and not with the spirochete with which we are chiefly concerned. In other words, it is the degree of the patient's reaction to the infection and not the infection itself that we measure. This at once makes it evident that advanced syphilis, tertiary conditions, where the antibodies are necessarily weak, yield only a one plus or at best a two plus, while the early cases register four plus. The diagnostic value of the Wassermann is then, unfortunately, greatest when a clinical diagnosis is also easiest and is least when the diagnosis is difficult. It also follows that the earlier condition with a four plus is easier to treat than the late tertiary with its weak positive.

With the Wassermann as standardized to-day, the four plus and the three plus should almost without exception be interpreted as syphilis. The two plus, though not conclusive, is strong evidence, while the one plus is inconclusive as many give the latter where resorption is active.

A positive Wassermann should always be reaffirmed by repetition, no matter what its strength; this is even more important in the weak positive. If the latter persists and the symptoms are not otherwise accountable, treatment should be inaugurated as likely to provoke a stronger Wassermann with an abatement of the symptoms. If the symptoms persist in spite of syphilitic treatment and the reaction remains unaffected, the weak Wassermann may be regarded as nonspecific. A persistent two plus Wassermann is usually syphilitic. Many doubtful cases with the nervous system involved are controllable by testing the spinal fluid.

During the treatment also, the reaction is of prime importance; the rule is that all syphilitic treatments must be controlled and checked by repeated tests. Furthermore, syphilitic treatments must not stop until a clear negative is secured which needs testing at intervals of from three to six months for a couple of years. Here, with the past history in view, weak positive Wassermans become of the utmost importance, as a reaction which otherwise from a diagnostic standpoint might be considered weak and insignificant becomes extremely important, clearly indicating continued treatment.

Basal Metabolism.—In neuroses and suspected thyroid dysfunction, this is sometimes an important addendum.

The gynecologist not infrequently sees neuroses in his field, which may be due to excessive or deficient thyroid activity; also, thyroid patients with minor pelvic ailments may imagine their disturbed nerve balance is pelvic in origin.

The determination of basal metabolism, once circumstantial and difficult, has been made comparatively easy in recent years. The objective is to determine any serious slowing up (hypo) or acceleration (hyper) of the processes of oxidation in the body per unit of time and per unit of body weight for comparison with standard tables of average norms.

The patient, after a prolonged rest, usually the first thing in the morning, breathes regularly in and out of a tank of oxygen containing soda lime to absorb the exhaled carbon dioxide. The amount of absorption is recorded on a revolving drum and read and compared with the norm, allowing fifteen points above and below for individual variations.

Microscopy.—This includes immediate freezing and staining of doubtful tissues in the course of an operation, routine sectioning and study of tissues later on, examination of secretions, staining for gonococci, tubercle bacilli, and other organisms, and, with dark field condenser, for spirochetes.

One of the greatest boons conferred in surgery is Cullen's method of making immediate diagnoses during the course of an operation by hardening tissue in formalin, freezing, cutting, and staining, and mounting, and examining under the microscope—within a few minutes accomplishing that which formerly took several weeks. Sections so made are so satisfactory that they can be put on file and often obviate further cutting of tissue. I have for years examined stained and mounted sections with a pocket lens magnifying about ten times; simply holding the specimen up to the light, the general architecture is plainly seen and the glands readily distinguished in their relation to the surrounding tissues. While a detailed microscopic study necessarily follows, I do not recall any instances in which an opinion based on the lens examination needed correction. T. S. Cullen has also long followed this method, using an inverted eyepiece.

CHAPTER V

DILATATION AND CURETTAGE

HOWARD A. KELLY

One of the most valuable of our so-called minor gynecological procedures is dilatation and curettage, so frequently done that it is commonly docketed in our protocols simply under the initials "D and C."

It consists in dilating or forcing a passageway through the narrow rigid cervical canal wide enough to afford ready access for small instruments to the uterine cavity to explore and remove tissue for diagnostic or therapeutic ends.

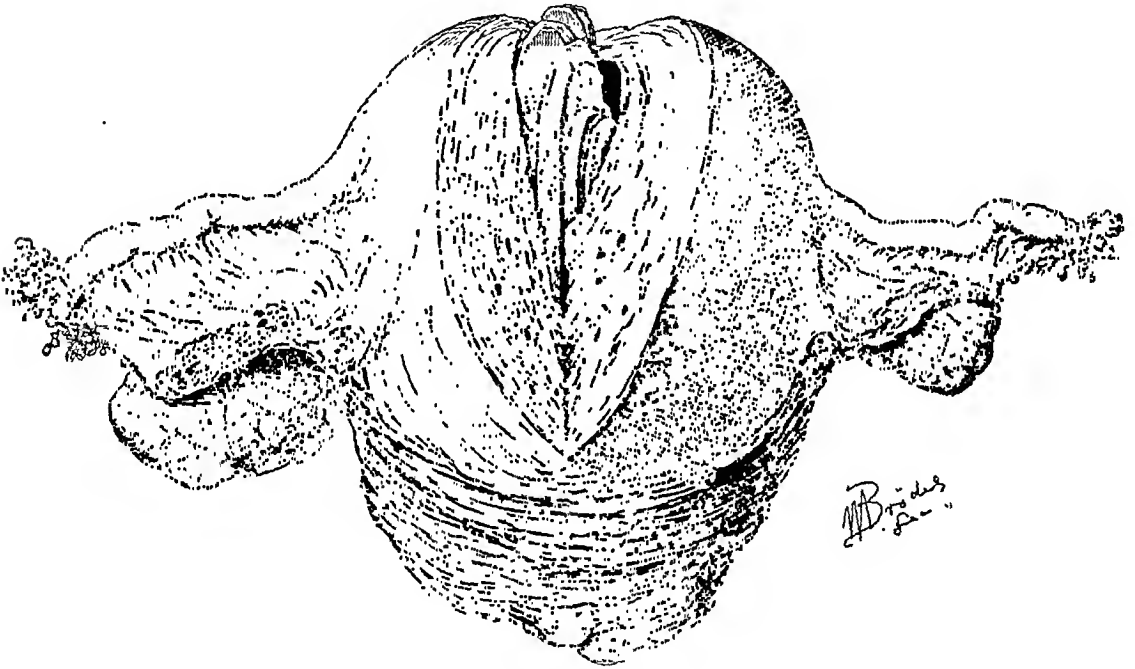


FIG. 85.—A CRIMINAL ABORTION, WITH SEPARATED ELM TENT IN SITU PARTIALLY PERFORATING UTERINE WALL. SEPTICEMIA AND DEATH. REMOVED AT AUTOPSY

A dilatation and curettage should be done in all abnormal uterine bleedings, except in young unmarried girls. Especially is it called for in every woman past the menopause who bleeds even a little, as well as in cases of fibroid tumors to exclude any malignant disease of the mucosa. Moreover, even though a patient has already been dilated and curetted once, should she return a year or more later with an abnormal flow, a fresh study of the endometrium should be made.

Our forefathers used laminaria, tupelo, and sponge-tents; these have been generally abandoned as they were apt to shut up the secretions and force infection out into the tissues and undoubtedly sometimes actually introduced infection. Sometimes, too, in unskillful hands, a laminaria tent perforated a uterus at the cervical junction or at the fundus, Figures 85 and 86. The accessibility of the uterine cavity secured by means of tents was superior to that by our present-day methods, especially when larger and larger tents were introduced in succession, and with better precautions we may be driven to revert to them sooner or later.

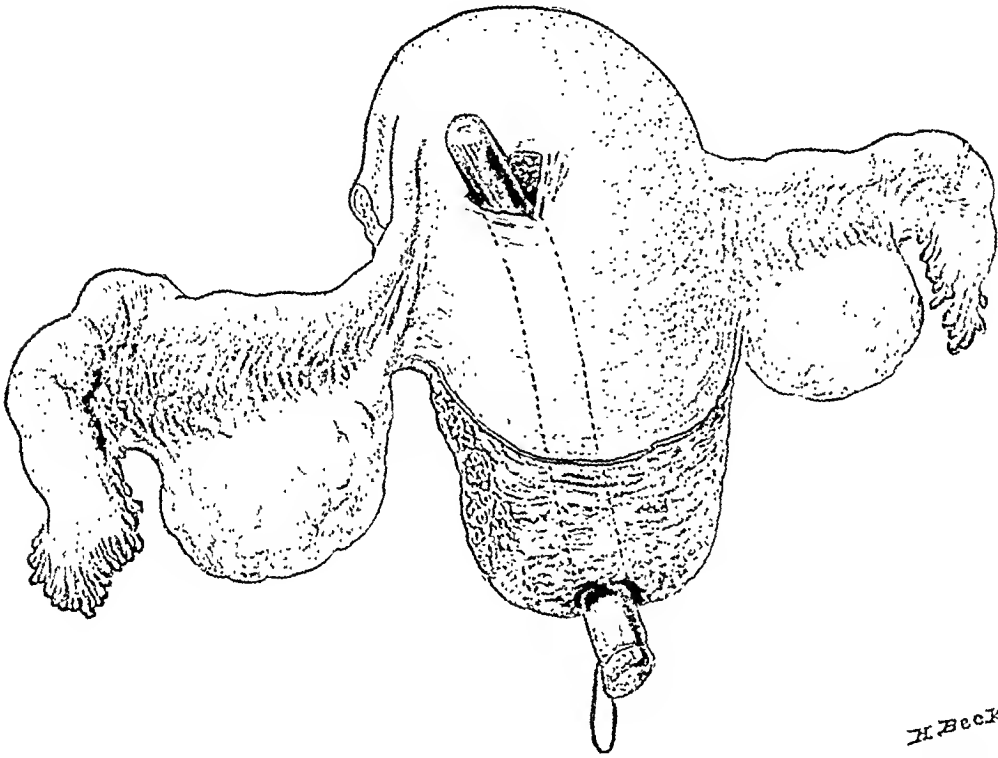


FIG. 86.—UTERUS PERFORATED BY A TUPELO TENT. PERITONITIS, HYSTEROSALPINGO-OÖPHORECTOMY, RECOVERY. (Operation by W. E. Ashton.)

Our present method consists in a rapid dilatation or divulsion of the cervix up to about 1 centimeter diameter, effected by two stout instruments opening with corrugated parallel blades.

Gas anesthesia permits a necessary thorough preliminary examination of the pelvis for any lateral inflammatory disease and the discovery of an enlargement of the uterus suggestive of pregnancy, contra-indicating operation. Local anesthesia can be secured by injecting a 1 per cent solution of novocain liberally into the tissue on all sides of the cervix.

The patient is placed in the lithotomy or an exaggerated lithotomy posture.

The outlet and the posterior vaginal wall are retracted by a Sims speculum and the cervix exposed and caught with a stout Fergusson or a bullet forceps, Figure 87. The vagina and cervix are cleansed quickly and not too energetically.

ally with an alcohol sponge. It is not necessary to do more to the vulva than to clip the hairs if they are in the way; there is no occasion for shaving.

A sound is introduced to ascertain the direction of the cervico-uterine cavity, and its depth from external os to fundus is recorded. A small dilator is then introduced and spread as widely as possible, stretching the canal and opening up the way for the larger dilator which follows immediately and creating a passageway about 1 centimeter or a little more in width.

An excellent way of dilating the canal is with the Hegar series of graduated dilators, Figure 88, beginning with one about 6 millimeters and proceeding by successive numbers to 10 or 12 millimeters in diameter—each one left *in situ* some twenty seconds. Where the dilatation is done for a therapeutic purpose as in dysmenorrhea, I think the Hegars are the best.

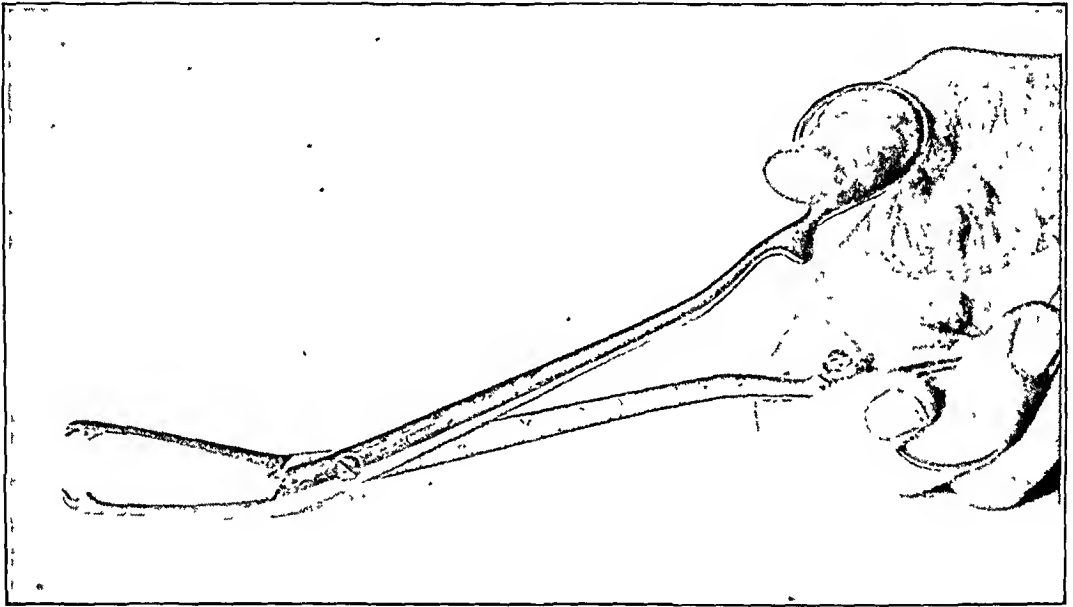


FIG. 87.—FERGUSSON TRACTION FORCEPS.

Immediately following dilatation, the curet is used, and the uterine walls are gently scraped. The tissue escaping at the *os cervicis*, often intermittently as the uterus contracts, is at once placed in a bottle of 5 per cent formalin and suitably labeled with the date, the name of the patient, and its source, and sent to the laboratory to be cut and mounted.

After curettage, it is well in hemorrhagic cases to use a polyp forceps, Figure 89, to discover and catch any small mucous or fibroid polyp or at least to ascertain its presence and determine upon a plan for further treatment.

One of the dangers of the operation of D and C is a rupture of the cervix out into the broad ligament; this is most apt to take place in the small uterus of an old woman. It can easily be avoided by using smaller instruments and not dilating so much. If it occurs, the surgeon should stop at once and close the tear with sutures. If by accident he interrupts an unsuspected pregnancy

(perhaps even in a case of sterility), there is nothing to do but keep the patient in bed and let the abortion take its course. A perforation of the body of the uterus with sound or dilator at the angle of flexure with the cervix or at the fundus is due to unskillful management; in one of the cornua, it is most likely in an abortion case when the tissues are soft and soggy. In crude hands in the effort to commit abortion, the perforation of the uterine tissues has repeatedly been followed by the use of placental forceps and the lugging out of the bowels of the patient through the rent until many feet have been delivered and *mirabile dictu* actually cut off! Unless the preliminary examination has excluded any lateral inflammatory disease, a lively peritonitis will now and then be lighted up by the traction upon the cervix in the effort to make it more accessible. If there is any doubt as to the status of these organs, the dilatation must be done without any displacement.

While it is customary to speak of D and C as "a simple operation" or as "hardly any operation at all," such terms are serious misnomers, for the operation demands the same care as to asepsis and a cautious thorough-going operative technique as any apparently more formidable procedure. The list of the deaths that occur yearly would be appalling if published.

In inexperienced hands, perforation is apt to take place in an anteflexed uterus at the uterocervical junction, or at the fundus, often near a tubal orifice. I cite a few which have come within my cognizance.

I, myself, have torn the cervix wide open into the broad ligament and opened the peritoneum, as evidenced by the prolapse of a tag of omentum. I opened the abdomen at once and found an unsuspected extensive peritoneal tuberculosis, removed the appendages and closed the rent, and the patient recovered.

A death was caused by a presumably reputable surgeon, but an abortionist (*Am. J. Obst.*, Jan. 1891), who borrowed my instruments. He pierced the posterior wall of the anteflexed uterus and tore a wide hole into the peritoneum into which he forced a coarse sponge-tenet. The patient died of acute peritonitis in spite of my opening and draining the abdomen.

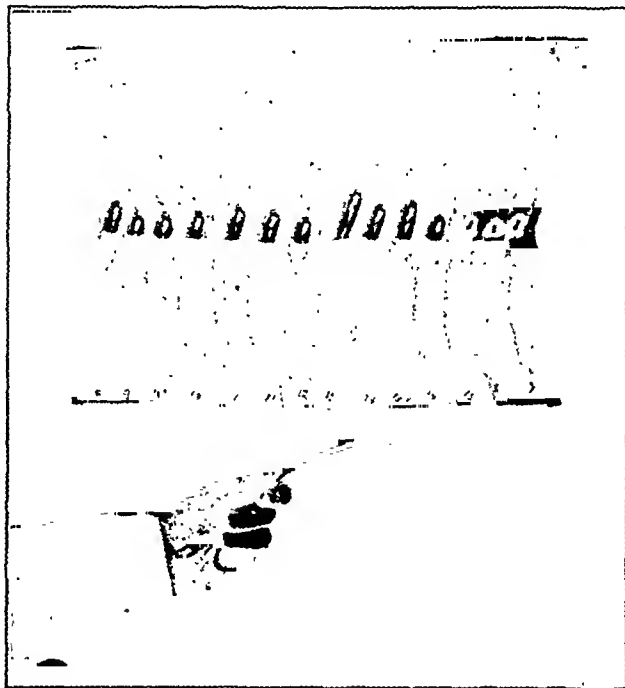


FIG. 88.—HEGAR DILATORS.

Valuable in slow dilatations of cervix uteri for dysmenorrhea, also in dilating urethra.

The dilatation ought never to be done with a ratchet and screw steadily forcing the blades apart, which must inevitably tear softened tissues wide open into the parametria.

Perforation of the fundus with a uterine sound has occurred six times in my experience without trouble following, but a death from peritonitis followed in the hands of an assistant.

In a case seen by M. D. Mann, of Buffalo, a young practitioner forcibly dilated the cervix to remove an ovum in an early abortion, induced by the patient with a catheter. In using a sharp curet and his finger, he caught and tore a loop of the intestine. Mann, called within an hour and a half, opened the abdomen and found a large hole in the center of the fundus, the ileum divided near the ileocecal valve and separated from its mesentery for 6 inches, and the cecum bruised and infiltrated and the abdomen contaminated with blood and feces. The patient recovered after the closure of the perforation

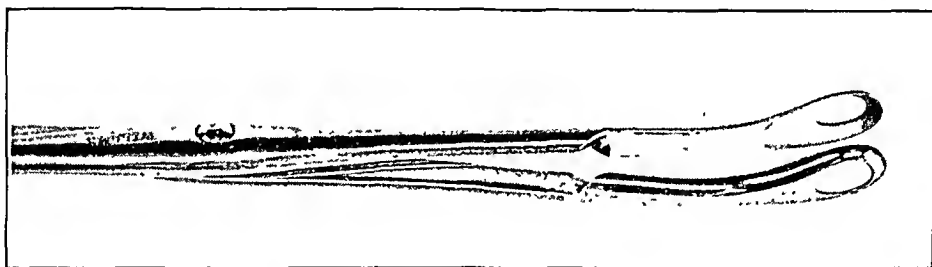


FIG. 89.—INTRA-UTERINE POLYP FORCEPS. STONE FORCEPS.

Forceps for removing friable tissue for microscopic examination.

and the removal of the detached bowel and an ileocolic anastomosis with a Murphy button!

J. B. Harvie, of Troy, New York, had an experience with a young practitioner who dilated the uterus and passed in a pair of forceps to catch the ovum and pulled down and cut off 6 feet of bowel without knowing what he had done.

In a similar case of extensive intestinal injury following the perforation of the uterus with a curet, C. P. Noble opened the abdomen and successfully resected 3 feet of the small intestine.

The operation is done:

1. To relieve dysmenorrhea
2. To cure sterility
3. To curette away a redundant endometrium
4. To extract a small fibrous or mucous polyp
5. To empty the uterus of the remains of an abortion
6. To diagnose malignancy, adenocarcinoma and rarely sarcoma, of the endometrium and uterine body
7. In general in any unexplained hemorrhage

While dilatation and curettage is elective in dysmenorrhea and sterility, it is mandatory in all persisting hemorrhagic cases in women in the thirties and older, and to neglect a prompt recourse to such a clarifying procedure is frequently simply to throw away valuable chances of recovery.

If a sound perforates the uterus, the depth to which it has entered should be noted and it should be withdrawn at once and the patient put to bed and watched, for if any untoward symptoms arise—fever, much local pain, chills—an abdominal operation should be done at once. I think in some instances a safe alternative would be to open Douglas's culdesac widely and introduce a liberal gauze drain.

If a hole is torn laterally in the uterus with a dilator, it ought to be sufficient to introduce a gauze drain.

It is the custom in some fashionable quarters to keep the patient in bed for a week after dilatation, and this may be well if she is a valetudinarian. The average woman, however, ought to be able to leave the hospital either on the same day or one or two days later, treating the matter as she would a menstrual period and wearing a pad for a few days while the moderate discharge lasts.

For many years, I have also done D and C operations in selected cases on my office table as part of the routine examination in hemorrhagic patients. Satisfactory conditions are: A cervix easily accessible, a canal easily dilatable, and a patient plucky and not neurotic and able to bear some pain for a short time.

The office procedure is as follows:

The instruments are always ready sterilized and kept wrapped in a towel.

The patient lies in the lithotomy position on the examining table, a Sims trivalve or speculum is introduced, and the cervix exposed. The upper vagina and cervix are swabbed with a cotton pledget saturated with alcohol. I then tell the patient she will have "three hurts": Hurt number one—The anterior lip of the cervix is caught with the bullet forceps and a sound introduced to ascertain the direction of the uterine canal; this is usually momentary. Hurt number two—As the cervix is pulled down a little, the canal is dilated with the smaller Goodell-Ellinger instrument, and by no means as much as under anesthesia, the object being to make the canal just patulous enough to admit a special small curet, Figures 90 and 91. The third and last hurt is the curettage, done quickly and covering the whole interior of the uterus which is also explored with the sense of touch transferred to the end of the curet, easily distinguishing any soft, boggy, yielding parts from the normal firm, gritty base. This sensation alone when felt is so definite that one can often declare at once with approximate certainty that there is no disease of the endometrium. It is not necessary to secure much tissue for the microscope, and if there is any disease it usually comes away easily and is ejected or flows out of the cervix.

Some cervical canals are so open that it is easy to pass a curet without dilating and even without the knowledge of the patient. Not infrequently the patients, themselves, have asked me to omit the anesthetic.

I have never seen an accident after this procedure in innumerable examinations of suspected uteri, including the healthy as well as many with carcinoma of the body and those with retained decidual products. If the intra-uterine polyp is suspected, one then uses a narrow-bladed polyp forceps and tries to grasp it.

If I find that the patient is excessively nervous, I always desist and arrange to complete the examination under anesthesia. An hour or two after such an office curettage, the patient goes home.

In this way, I save much time and put the diagnosis through quickly and save the patient unpleasant anticipations and the expense of hospital care.



FIG. 90.—SHARP CURET
FOR REMOVING UTER-
INE MUCOSA. $\times 1$.



FIG. 91. — SERRATED
FENESTRATED CURET.

Serrations should be
rather sharp and a little
deeper than shown.

One can often determine at once with approximate accuracy, and without waiting for the laboratory report, the probable nature of the case, especially when bearing in mind the clinical history.

An abundant flabby endometrium discharged in long pieces is found in hemorrhagic cases but is rarely malignant.

An endometrium coming away in quantity in whitish firmer blocks is likely to prove cancerous.

An abortion either presents a quantity of flabby decidua or villi or, if older, pieces of tissue with small foci of old hemorrhages.

Again, especially in older women, where little or no tissue is secured, it is likely to prove a favorable sign, although there are notable exceptions to this rule.

In all cases, a competent pathologist should pronounce upon the tissue removed, and a slide ought to be kept on file with the patient's record.

Following a D and C it is safer not to push any swab up into the uterus.

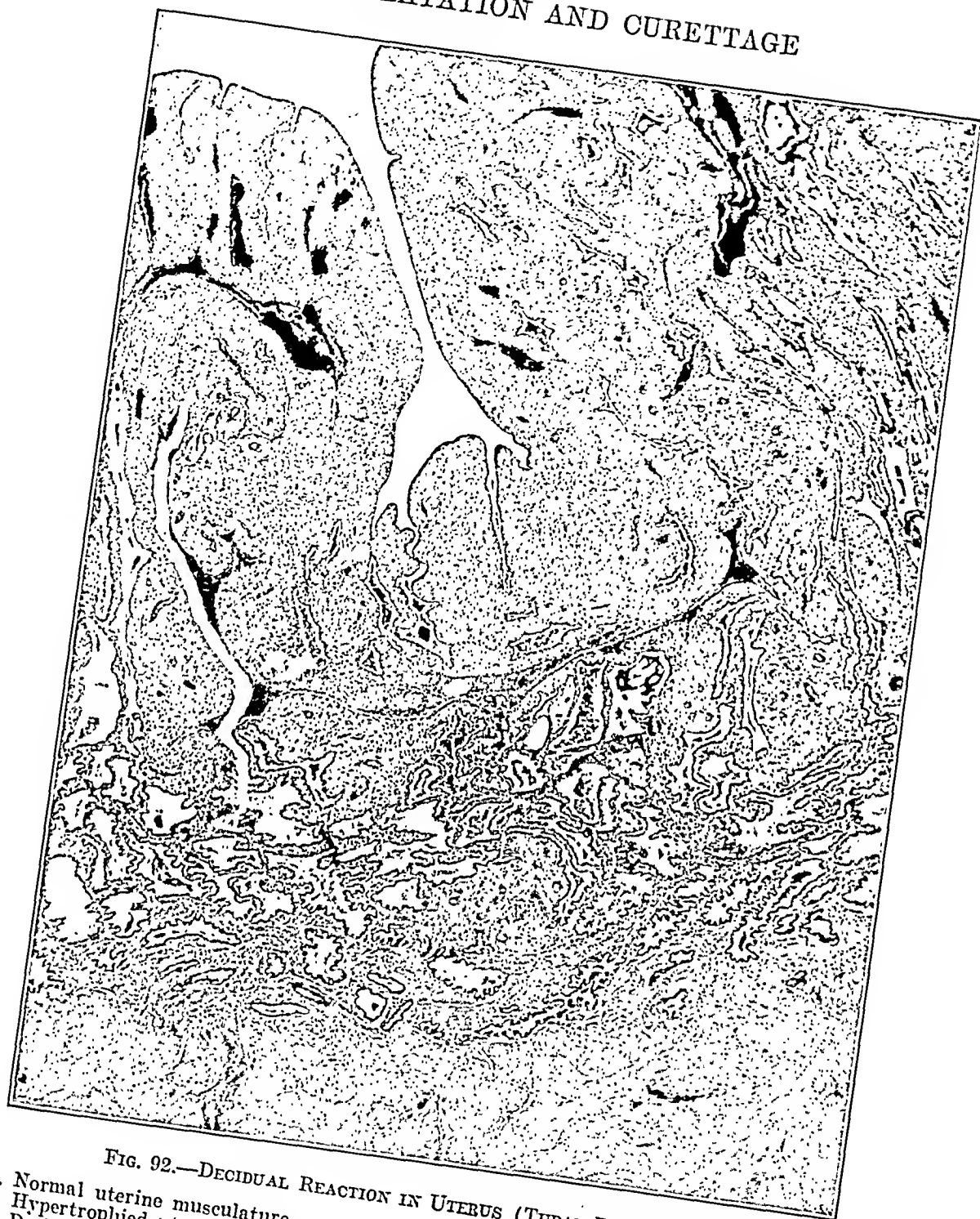


FIG. 92.—DECIDUAL REACTION IN UTERUS (TUBAL PREGNANCY).

1. Normal uterine musculature.
2. Hypertrophied uterine glands.
3. Decidual reaction of stroma in superficial layer of endometrium. (J. H. U., Gyn.)

× 50.

or to inject the uterine cavity with the long-nozzled uterine syringe, fortunately not so common now as a generation ago.

I. C. Rubin has clearly shown that patulous tubes easily admit of a reflux from the uterine cavity out on to the adjacent peritoneum, with all its baleful

consequences if the material happens to be infectious and with intense pain if the irritant is chemical (*Am. J. Obst.*, 1918, 2).

J. A. Sampson also has shown that if the endometrium is damaged as in curettage, an injection may readily escape into open venous sinuses and lodge as far out as in the ovarian and uterine veins in easy communication with the large central venous system.

CHAPTER VI

CONGENITAL MALFORMATIONS AND DEVELOPMENTAL DEFECTS

LAWRENCE R. WHARTON

APLASIA

HERMAPHRODITISM

True

Pseudo

MASCULINE

FEMININE

INHIBITIONS

Müllerian Union

COMPLETE NONUNION

INCOMPLETE UNION

Vaginal Atresia

Fusion of the Labia

Imperforate Hymen

Secondary Sex Characteristics

Congenital malformations and developmental defects are classified, for convenience, according to their causes, although the demarcation is often indistinct due to an overlapping of characteristics.

APLASIA

This group includes cases in which the predominant lesion is complete absence of the organs.

The ovary is rarely absent, but as it may lie displaced into the upper pelvis, the iliac fossa, the groin, the labia, or even in remote retroperitoneal regions, ovarian aplasia can only be diagnosed after a most careful search.

Nagel stated that ovarian aplasia occurred only in monsters, mostly non-viable; in 1923, however, Eismayer collected ten cases of unilateral absence and one bilateral; some were normally formed and mature. As a rule, there is homolateral absence of the fallopian tube, and in half of the group there was an absence of the corresponding kidney. The other pelvic organs are rudimentary at times.

The fallopian tube and half of the uterus may be absent, giving rise to uterus unicornis unicollis. Often a unicornuate uterus functions normally in every respect.

Absence of the vagina rarely occurs without grave developmental defects in the upper segments of the müllerian ducts; it is commonly associated with double uterus and nonunion of the müllerian ducts and will be considered under that head.

HERMAPHRODITISM

Regardless of the sex of the individual, the primordia of male and female reproductive organs are formed in every embryo, the gonads (testicles and ovaries) being the exception. As development proceeds, the organs of the recessive sex become stationary and remain as vestiges. When gonads of both

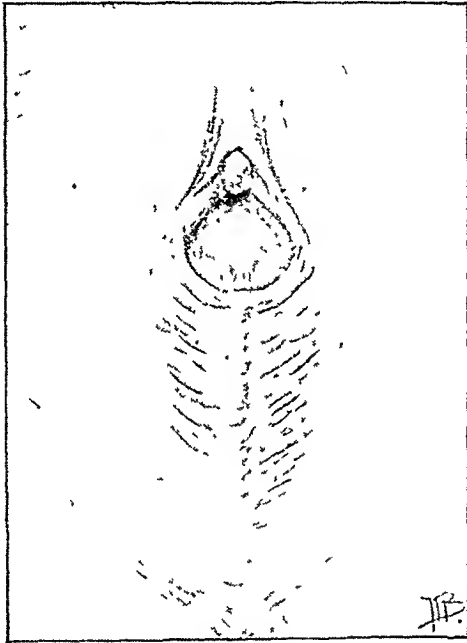


FIG. 93.—AGGLUTINATION OF THE LABIA IN A CHILD.

Note distinct raphe in middle, with membrane on both sides, concealing urethra and hymen.

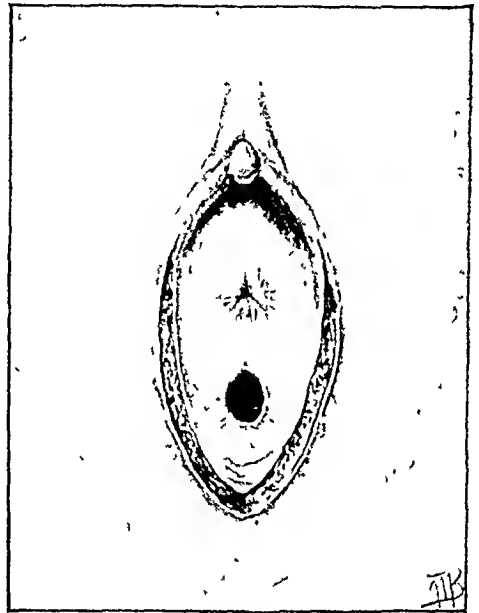


FIG. 94.—AGGLUTINATION OF LABIA.

Same case after division of membrane; urethra and hymen exposed.

sexes are formed or the organs of the opposite sex do not recede but advance to a more or less complete developmental state, the result is hermaphroditism or bisexuality which is always a purely anatomical abnormality almost invariably associated with sterility of one or both reproductive systems. With this reservation, hermaphroditism is said to be *true* when one individual possesses both testis and ovary regardless of their functional capacity, and *false* when only one type of gonad (testicle or ovary) is present. In true hermaphroditism, aside from the gonadal bisexuality, there may or may not be bisexuality of the remaining reproductive organs; in the false type, the gonads are of one sex only, whereas the rest of the genital apparatus may appear remarkably duplicated.

True.—True hermaphroditism was seriously doubted as recently as 1911, but within the past few years authentic cases have been recorded by A. Shepard (*Anat. Rec.*, 1920, 19), J. C. Masson (*Am. J. Obst. & Gynec.*, 1925, 9), and H. H. Young (*Johns Hopkins Hosp. Bull.*, 1924, 35).

Pseudo.—Pseudohermaphroditism, although rare, is much more frequently found than the genuine. The usual classification of pseudohermaphroditism is that of Klebs which, simplified, is: Masculine pseudohermaphroditism in which testes are the only gonads present; feminine pseudohermaphroditism in which the only gonads are ovaries.

In pseudohermaphroditism, the sex is determined by the type of gonad present, although the real and the apparent sex are often at variance, the masculine type being commoner than the feminine, in the ratio of three to one.

Histological examination of the gonad is the court of last resort, an appeal not often taken. Where a decision cannot be rendered, it is better to raise the infant as a boy as three-fourths of all pseudo-

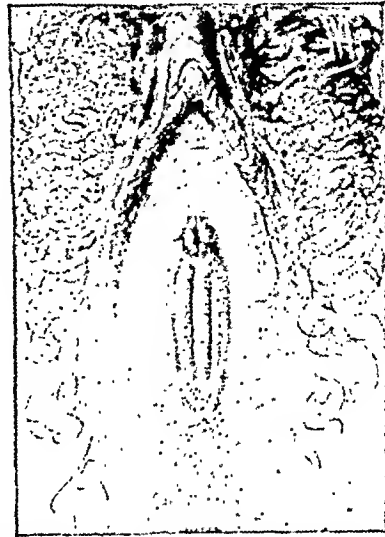


FIG. 95.—ENTIRE. ABSENCE OF VAGINA, WITH INDICATION OF DOUBLE HYMEN. EXTERNAL GENITALS NORMAL.

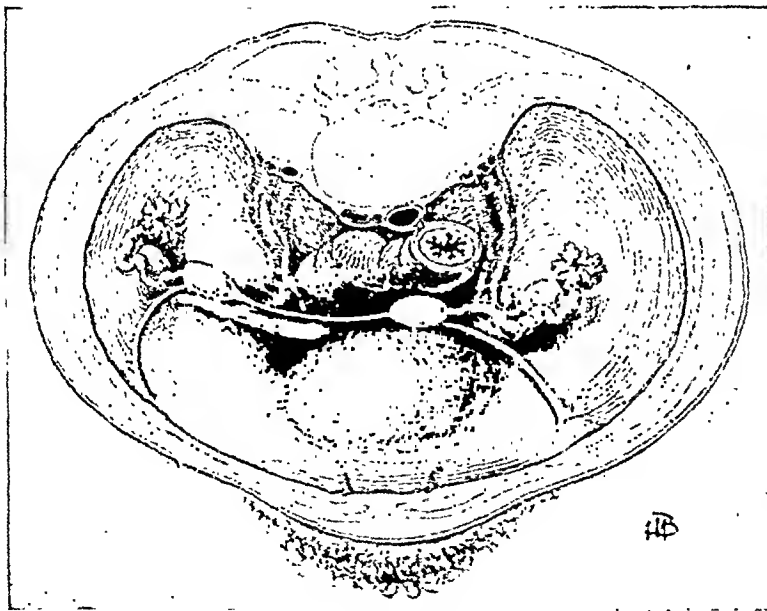


FIG. 96.—RUDIMENTARY UTERI, TUBES, AND OVARIES IN COMPLETE ABSENCE OF VAGINA.

Each tube (müllerian duct) ends in uterine nodule; nodules separated by several centimeters and connected by thin band. Round ligament attached to each nodule. Vicarious rectal menstruation.

hermaphrodites are males. When asked to pass judgment on an adult where it is evident that the sex has been mistaken, one must hesitate long before altering the entire social status of the individual.

Masculine.—In masculine pseudohermaphroditism, the bisexuality is one of three sorts, depending on the female elements. If the internal genitalia are



FIG. 97.—LEFT TUBE, OVARY, AND UTERINE NODULE. TUBE AND OVARY, NORMAL SIZE.

Membrane below, with parallel folds, occupies the position of uterine body and vagina.
 × 1.

those of a woman and the external predominantly masculine, it is called *internal masculine pseudohermaphroditism*. If the müllerian ducts have not developed



FIG. 98.—NORMAL RIGHT TUBE, NORMAL OVARY, AND UTERINE NODULE, CONTAINING UTERINE MUCOSA AND GLANDS.

but the external genitalia are predominantly feminine, it is *external masculine pseudohermaphroditism*. If the internal and external genitalia of both sexes are equally developed, the condition is *internal and external masculine pseudo-*

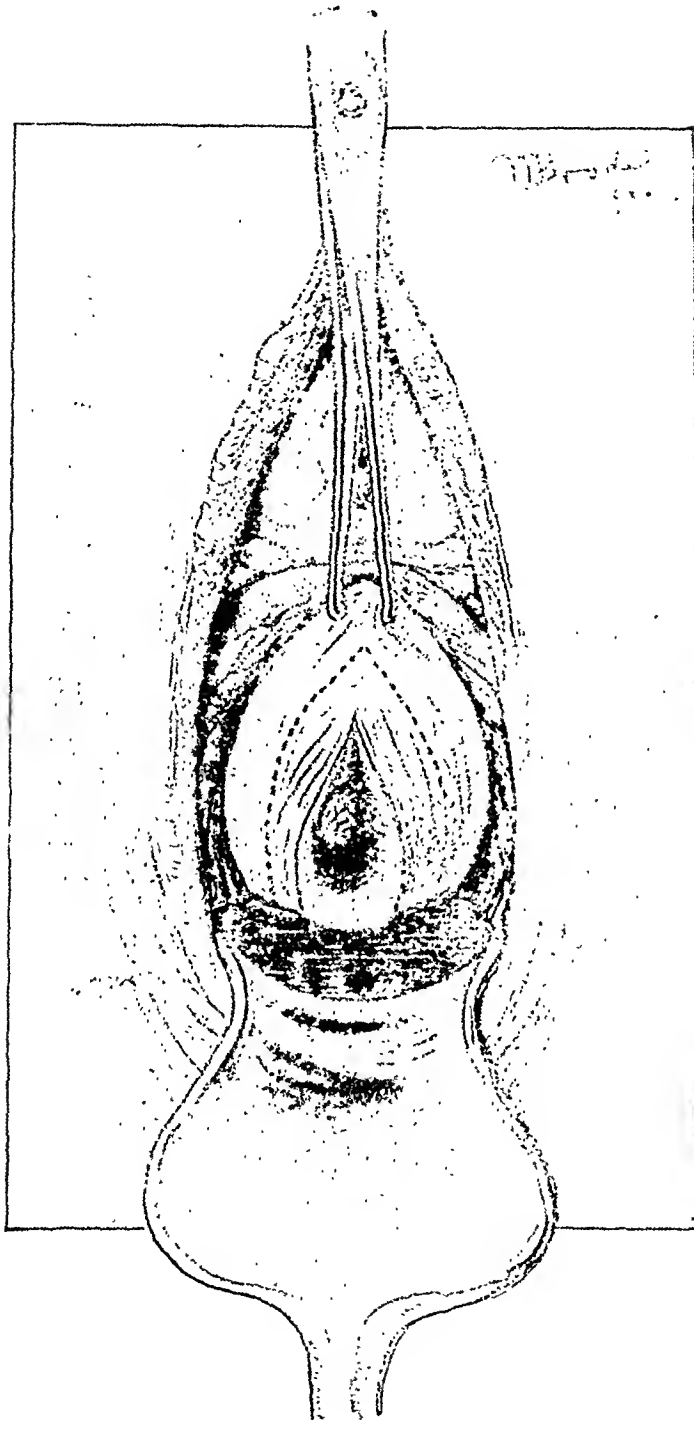


FIG. 99.—TRAUMATIC ATRESIA OF VAGINA WITH ACCUMULATION OF MENSTRUAL SECRETIONS ABOVE.

A median incision allowed the thick, tarry blood to escape. Membrane then excised along dotted line.

hermaphroditism. In all types the ovaries are entirely missing, the only gonads being testicles.

The striking characteristic of this masculine pseudohermaphroditism is the frequency of the external habitus of the female—a beardless face, large breasts,

high-pitched voice, broad hips, and external genitalia closely resembling the female. The penis is usually small, and the divided empty scrotum resembles labia (cryptorchidism), with hypospadias naturally suggesting that the individual is a female.

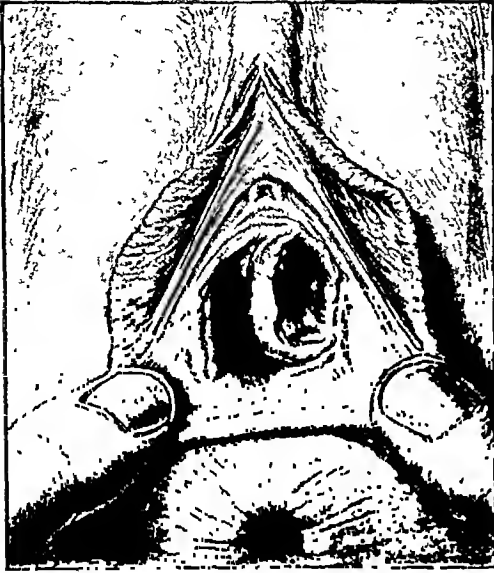


FIG. 100.—DOUBLE VAGINA WITH THICK FLESHY SEPTUM.

These cases are chiefly interesting sociologically as established secondary sex characteristics cannot be altered by any therapeutic measure. Many such hermaphroditic males, ignorant of their real sex, have lived happily as females. Some have married other males and have lived happily.

Some homosexual perverts are hermaphrodites; Neugebauer tells of a case in which a young woman conceived after homosexual relations with a pseudohermaphroditic male supposed to be a female. Pseudohermaphroditic prostitutes are

known to have plied their trade both as male and female.

Feminine.—Feminine pseudohermaphroditism is much less common. In these cases, the gonads are ovaries, although the secondary sex characteristics and external genitalia may be predominantly masculine. Such individuals often possess the bodily contour of the male—a man's voice, a bearded face, a large bony and muscular frame—and their affection is for women.

INHIBITIONS

Müllerian Union.—Faulty union of the müllerian ducts may give rise to a number of gross uterine malformations, varying from complete separation to minor grades of incomplete union and the persistence of septa with no clinical significance.

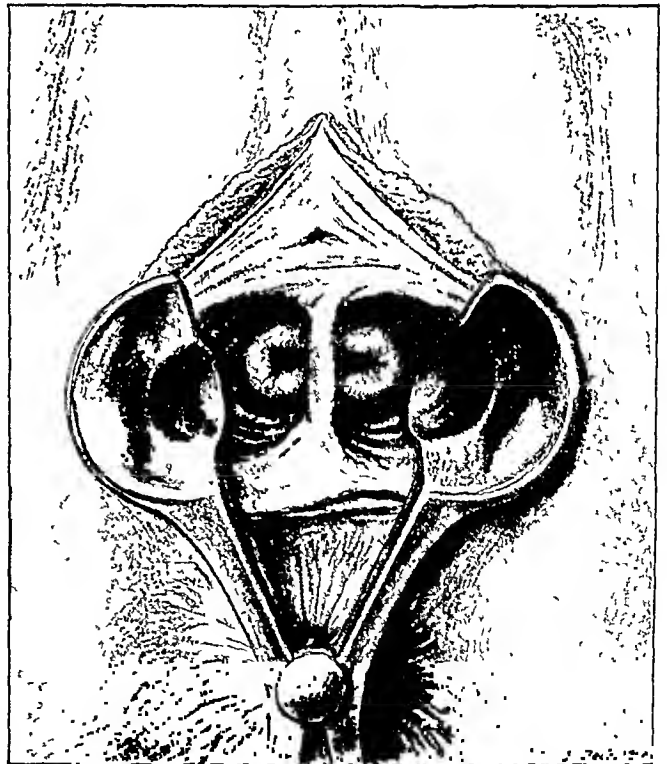


FIG. 101.—DOUBLE VAGINA AND DOUBLE CERVIX; SEPTUM IN MIDDLE.

Complete Nonunion.—Complete nonunion of the müllerian ducts is not incompatible with normal function, sexual relations, menstruation, and reproduction, if one or both of the ducts acquire full development. The result is two more or less completely separate uteri and vaginae. There have been numer-

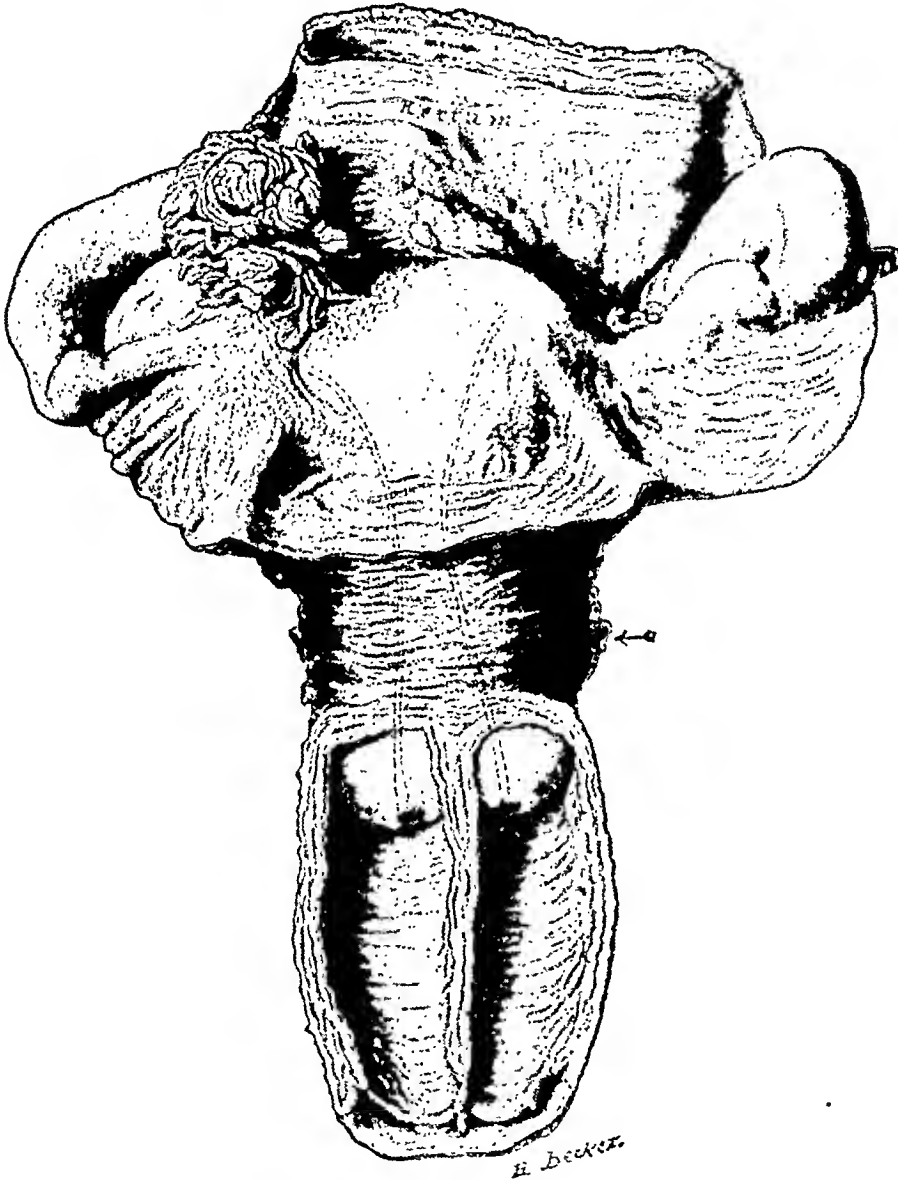


FIG. 102.—DOUBLE UTERUS, DOUBLE VAGINA, AND PLANIFORM FUNDUS.

Uterine cavities indicated by double lines. Arrow indicates point of cross section shown in next figure. (G. Y. Rusk.) $\times \frac{9}{10}$.

ous instances of twin pregnancy, with one in each uterine horn, carried to term and delivered without complications.

As a rule, however, one of the ducts fails to develop fully. At times, both ducts are diminutive stunted cords of solid fibromuscular tissue containing a few islands of scattered cylindrical epithelium or with a lumen lined by normal tubal epithelium. There is usually evidence of the effort to form a uterus in

the bulbous enlargements at the caudal ends of the müllerian ducts, with or without cavities lined by endometrium.

The symptoms are usually pronounced when the menstrual flow accumulates in the diminutive cavities (hematometra), in the tubes (hematosalpinx), or in the peritoneal cavity.

Incomplete Union.—Incomplete union of the müllerian ducts may result in a bicornuate uterus, a septate uterus, a double cervix, or a septate vagina. The symptoms attending such malformations are slight; often, none. Obstetrical complications may ensue if a pregnancy develops in an undeveloped horn of a bicornuate uterus. The vaginal septa may cause dyspareunia.

Vaginal Atresia.—During the later development of the genital tract, the failure of the lower ends of the müllerian ducts to form a lumen or to establish

an exit at the introitus gives rise to a vaginal atresia with a blind external pouch 1 or 2 centimeters in depth. With menstruation, blood collects in the uterus or vagina, and in time surgical intervention becomes necessary.

Treatment varies with the individual. The restoration of a functioning vaginal lumen is secured by Baldwin's operation which detaches a loop of the small intestine and sews it into the area tunneled out between rectum and bladder. Small defects are compensated by excising the atretic area and sliding the vaginal walls over it and uniting them by suture.

Fusion of the Labia.—The labia majora and at times the minora occlude the vaginal opening, corrected by a clean median incision.

Imperforate Hymen.—This causes a collection of menstrual blood in the vagina (hematocolpos). When incomplete, the chief symptoms are dyspareunia and sterility, and, with irritation, vaginismus and often a psychoneurosis. Excision is the proper procedure (hymenectomy).

Secondary Sex Characteristics.—The secondary sexual development goes on in puberty and adolescence when the puerile reproductive organs advance to functional maturity. If this is arrested, they then retain an infantile or puerile type, entailing sterility. These cyclic changes depend upon the due interaction of the secretory internal glands.

In 1901, Fröhlich called attention to the interesting syndrome, dystrophia adiposogenitalis, which he attributed to hypopituitarism, characterized by obesity and genital hypoplasia. During adolescence, minor grades are frequently seen, at times temporary and disappearing more or less completely in a few years; sexual maturity is merely delayed and menstruation irregular until the dysfunction is overcome. When this condition becomes fixed, genital infantilism persists, menstruation remains irregular, and sterility is the rule.

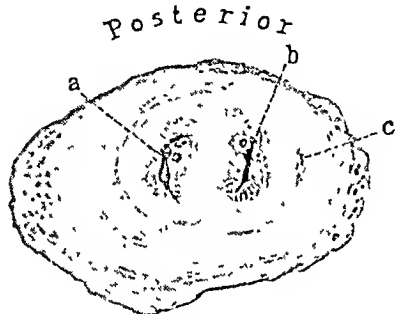


FIG. 103.—SECTION THROUGH CERVICES ABOVE VAGINAL VAULT.

a and *b* mark the right and left uterine cavities; *c* is Gartner's duct. $\times 1$.

On the other hand, genital hypoplasia, amenorrhea, and sterility are not necessarily associated with obesity; there may even be a marked undernutrition, evidently due to a different endocrinopathy. One sometimes finds glycosuria

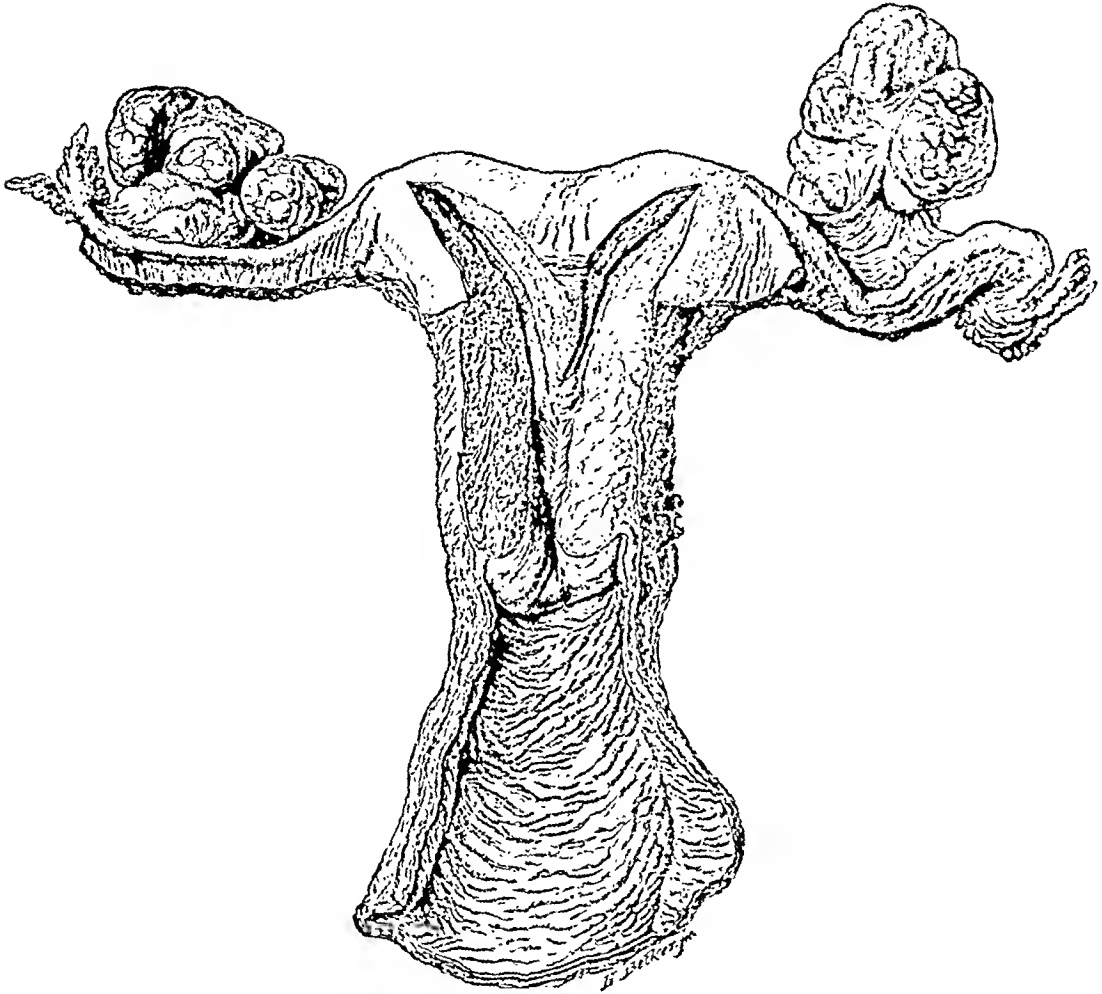


FIG. 104.—BICORNATE UTERUS WITH CARCINOMA OF BOTH OVARIES.

Normal vagina, normal cervix, typical depression at fundus, and divided uterine cavity.
(G. Y. Rusk.)

in Fröhlich's and in other types of infantilism. As a rule, however, these patients have good health and no complaints except those referable to the pelvis.

The hypoplasias yield to no treatment, medical or hygienic.

CHAPTER VII

MENSTRUATION, AMENORRHEA, DYSMENORRHEA

EMIL NOVAK

MENSTRUATION

Clinical Characteristics

PERIODICITY

DURATION

AMOUNT

DISCHARGE

MOLIMINA

MENSTRUAL WAVE

MENOTOXIN

Puberty

AGE

GENERAL BODY CONTOUR

CHANGES IN GENERATIVE ORGANS

SEX CONSCIOUSNESS

Anatomic Changes

CHANGES IN ENDOMETRIUM DURING MENSTRUAL CYCLE

Postmenstrual Phase

Interval Phase

Premenstrual Phase

Menstrual Phase

CHANGES IN OVARY DURING MENSTRUAL CYCLE

Ovulation

Corpus Luteum Cycle

1. Proliferation or Hyperemia

2. Vascularization

3. Maturity

4. Retrogression

Corpus Luteum of Pregnancy

Atresia Folliculi

Menopause

AVERAGE MENSTRUAL LIFE

PREMATURE MENOPAUSE

MENOPAUSAL SYMPTOMS

1. Cessation of Menses

2. Vasomotor Symptoms

3. Nervous and Psychic Symptoms

4. Constitutional Disturbances

TREATMENT

AMENORRHEA

Etiology

LOCAL

Congenital Absence or Malformation in the Generative Apparatus

Acquired Pathological Lesions of Pelvic Organs

GENERAL

Physiological

Acute Infectious Diseases

Chronic Debilitating Diseases

Mental Diseases

Functional Defects

Treatment

DYSMENORRHEA

Etiology of Primary Dysmenorrhea

MECHANICAL OBSTRUCTION OF UTERINE CANAL

NEUROSIS

HYPOPLASIA OF THE ORGANS

Etiology of Secondary Dysmenorrhea

Treatment

RELIEF DURING ATTACK

General Measures

Drugs

PERMANENT RELIEF

Primary Dysmenorrhea

1. Rapid Dilatation of Cervix

2. Continuous Dilatation with Stem-Pessary

3. Plastic Operations on Cervix

Secondary Dysmenorrhea

Membranous Dysmenorrhea

"Nasal Dysmenorrhea"

INTERMENSTRUAL PAIN

MENSTRUATION

The theories of menstruation most popular among our predecessors were (1) that the menstrual cycle is under the influence of the lunar cycle; (2) originating with Galen, that women are naturally plethoric and that menstruation affords a periodic relief; (3) that menstruation is due to a ferment in the blood, the fervor uterinus of Democritus.

The theory of Pflüger (1863), that menstruation is due to a nervous reflex emanating from the ovary due to the increasing size of maturing follicles, is now replaced by our modern endocrine or hormone theory.

The ovum is thrown off at about the thirteenth or fourteenth day of the cycle, allowing for variations. As it passes down the tube, the endometrium undergoes preparation for it. The earlier and more gradual developmental changes in the uterine mucosa are probably due to the hormone influence of the

maturing follicle taken up later by the early corpus luteum. When the latter becomes mature, the more striking secretory and hypertrophic changes of the premenstrual period are visible in the endometrium. In the event of pregnancy, these pass by easy transition into the picture of the young decidua. On the other hand, if the ovum reaches the end of its life span of presumably two weeks without being fertilized, the elaborate preparation made by the endometrium is useless, and the endometrium dismantles itself; some of it is cast off with an attendant hemorrhage, this catabolic stage being what we call menstruation.

Clinical Characteristics.—A striking characteristic of menstruation is its *periodicity*. In more than 80 per cent of normal women, the interval between periods is twenty-eight days, and when this is not the rule, it is commonly some multiple of 7; *i.e.*, twenty-one days, or fourteen, or thirty-five. Intervals of other lengths, twenty-five, twenty-six, or thirty days, are not rare. Under abnormal conditions, there are wide variations.

The average *duration* is from three to five days with marked individual variations, many menstruating normally but one or two days and others six or seven, who are in every way normal.

There is a wide difference as to the average *amount* of blood lost. Perhaps the most accurate determination is that made from the hemoglobin recoverable from the napkins; the blood loss is from 2 to 8 ounces for the average woman.

The *discharge* consists of blood, mucus, desquamated epithelial cells, granular detritus, and bacteria. The most interesting characteristic is its non-coagulability, a property which has given rise to much study but is not yet understood. The endometrium here appears to play an important biological rôle, either by adding an antithrombin or by abstracting some essential substance.

The subjective manifestations are the *menstrual molimina* which in a healthy woman are mild, consisting of a slight sense of weight in the pelvis and perhaps a mild lassitude. Actual pain is not to be accounted as normal. Other variable symptoms are irritability, slight depression, frequent urination, constipation or diarrhea, anorexia, slight pains in the breasts, and swelling of the thyroid gland. Occasionally one sees a "menstrual toxemia," with vomiting and headache.

From Raciborski's publication in 1868 and the later papers of Stephenson and Mary Putnam Jacobi, there have been frequent discussions of a metabolic wave process, corresponding to the *menstrual wave*. The problem is not a simple one and there is no unanimity of opinion. Some observers record a slight rise in temperature, pulse, and blood-pressure, while others report the contrary.

In 1920, Schiek reported that the secretions of women during menstruation contain some substance unfavorable to plant life, apparently supplying a scientific basis for many ancient superstitions. His studies were confirmed by Macht who suggested that *menotoxin* is related to oxysterin. More recently Labhardt as well as Schubert and Stending discredit these notions.

Puberty.—The analysis of over ten thousand histories in the United States and Canada by Engelmann showed that the average *age* at which menstruation begins (menarche) is 13.9 years.¹

The inauguration of menstruation is but one of the group of manifestations marking the transition from childhood to womanhood, constituting collectively the epoch of puberty.

Up to puberty, there is no important difference in the *general body contour* of the sexes. At this time, the female figure becomes rounded with adipose tissue, especially about the hips, the breasts become fuller and rounded, and hair appears on the mons veneris, the labia majora, and the axilla. The change of voice, so striking in the male, is much less noticeable.

Changes in the generative organs consist chiefly in increased prominence of the labia majora, previously flat, to form long, fatty folds to surround the labia minora. The uterus, up to this time diminutive and consisting chiefly of cervix, now undergoes striking development in the marked enlargement of the corpus, the cervix remaining unchanged. The tubes and ovaries increase in size, the former losing their tortuosity, and the latter giving evidences of ovulation with attendant histological changes.

Up to puberty, there is little *sex consciousness*, but at this epoch the new impulse appears. Its importance is largely individual, modified by home surroundings, companionship, and education.

Anatomic Changes.—The menstrual discharge arises entirely from the endometrium, the mucous membrane of the uterine body, the cervical mucosa not participating.

Changes in Endometrium during Menstrual Cycle.—The endometrium was formerly described as of a fairly fixed histological structure. Chiefly from the investigations of Hitschmann and Adler, 1909, we know that during the reproductive period of life the endometrium changes from day to day, so that just after menstruation, for example, it is far different from an endometrium just before the flow. This new knowledge has greatly changed our ideas about its pathology, and a variety of conditions formerly held pathological are now obviously normal. The cycle of histological changes is here summarized:

Postmenstrual Phase.—The postmenstrual phase, Figure 49, embraces the four or five days following the flow when the mucosa is quite thin and the surface and gland epithelium of a rather low columnar or cuboidal type. The glands are straight and narrow in cross section, forming small cir-

¹The question of early maturity is not so much one of latitude as of the immediate environment of clothing and house heating. V. Stefansson, eminent explorer, has noted that maturity takes place among the Eskimos about as early as in the south of Europe, owing to the intense heat of their igloos where the women are housed through the winter (temperature 80 or 90 degrees) and the double layer of fur clothing worn. They would seem for a large part of the year practically to live in a Turkish bath. "It is not rare among Eskimo women that they have their first child at the age of twelve, and children born before the mothers were eleven have been recorded." These data are "strictly in accord with the supposition that the hotter the environment, the earlier the maturity."

cles, and in longitudinal section rather slitlike. The stroma is dense, and the active regenerative processes furnish mitoses both in epithelium and in stroma.

I n t e r v a l P h a s e.—Following the postmenstrual phase, there is a gradual developmental thickening from day to day, the epithelium becoming higher, the glands gradually more and more tortuous, and the stroma remaining compact. As the interval phase, Figures 44 and 45, lasts about two weeks, the early interval picture differs from that of the late interval. This is particularly true of the gland pattern; in the early picture the tortuosity of the glands is slight, while in the later, it may be extremely marked.

P r e m e n s t r u a l P h a s e.—Four or five days before the onset of menstruation, the premenstrual phase (pregravid or secretory) sets in, Figure 46, and there is a rather abrupt developmental change, the endometrium becoming considerably thicker and perhaps somewhat edematous and spongy, not infrequently being as much as 7 or 8 millimeters in depth. The histological picture is now quite different from any previous one, the most marked feature being the evidence of the secretory activity of the epithelium, more particularly of the glands. The surface epithelium which may be quite high, while that of the tortuous glands is low and mucoid in appearance, exhibits but little of this change. The gland cells take a pale stain and appear to melt away into a secretion in the lumen. The glands pass as fairly straight tubules through the superficial or compact layer of the endometrium, but below this the lumina become much convoluted. This stratum, because of the abundant gland lumina, is called the spongy layer. The lining epithelium appears thrown up into tuft-like eminences, due to the spiral twisting of the glands. The very tips of the glands often penetrate the uterine muscularis, there being no submucosa. These gland extremities, curiously enough, take no part in the cyclic menstrual changes, so, in the premenstrual phase and yet more in early pregnancy, this deepest or basal layer stands out sharply defined from that above it.

The stromal cells, especially in the superficial stratum, often show a marked hypertrophy not infrequently resembling decidual cells. Again, this hypertrophic change is less marked. From this, it is evident that the premenstrual changes resemble those of early pregnancy, and are hence spoken of as pregravid or predecidual.

In the event of pregnancy, the premenstrual phase passes by transition into a real decidua. If the ovum has not been fertilized, the endometrium then dismantles itself by a catabolic process accompanied by menstrual bleeding. There was for years a doubt as to whether menstruation is accompanied by the loss of the endometrium. Schroeder's studies, confirmed here by Novak and TeLinde, have shown conclusively that there is regularly a considerable though probably variable loss.

M e n s t r u a l P h a s e.—Immediately before menstruation the intense infiltration of the mucosa with leukocytes and wandering cells and the poor staining of the tissue cells give every evidence of impending desquamation. On

the first day of the flow, the upper layers crumble away in large and small particles, and by the second day the whole compact layer and perhaps a portion of the spongy are not infrequently lost. By the third day, there are usually evidences of regeneration beneath the desquamating particles, chiefly from the epithelium covering the stumps of the glands and so restoring the surface. The menstrual hemorrhage is partly due to actual rhexis, Figure 47, although diapedesis, Figure 48, no doubt also plays a part.

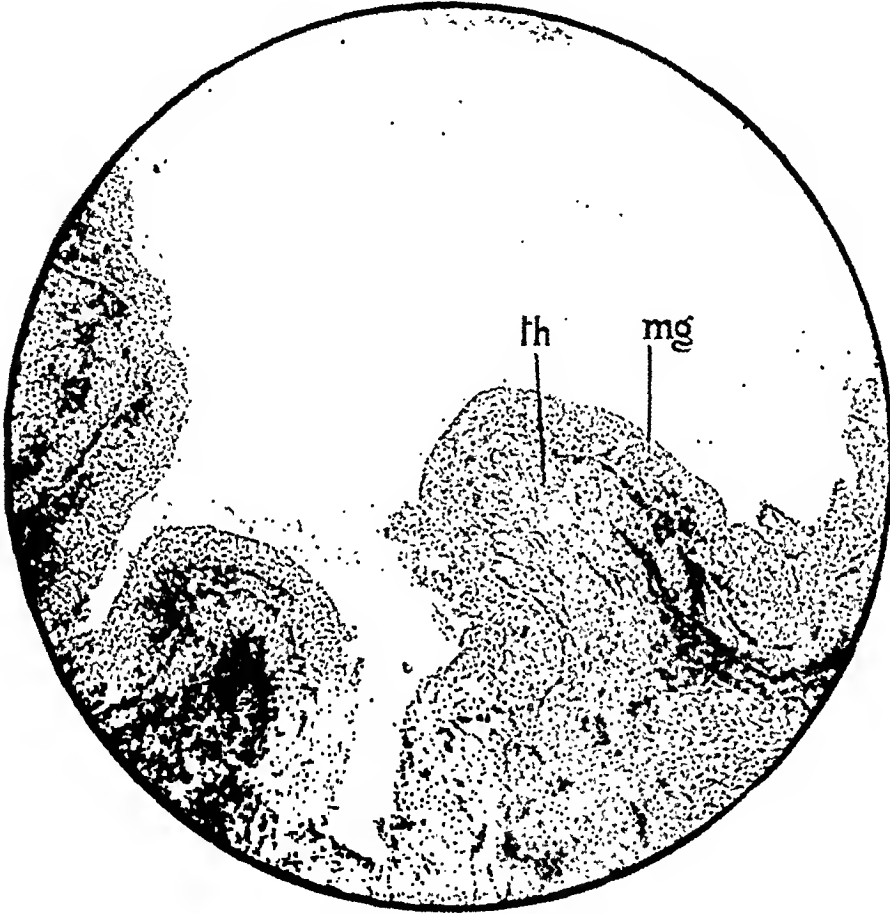


FIG. 105.—PORTION OF WALL OF EARLY CORPUS LUTEUM, REMOVED ON TENTH DAY OF CYCLE (LOW POWER).

mg, membrana granulosa; *th*, theca interna. Note vascular line of demarcation between these two layers.

Changes in the Ovary during Menstrual Cycle.—Ovulation.—There was formerly much difference of opinion about the connection between ovulation and the menstrual periods. Our modern histological studies, especially those of very early corpora lutea, apparently fix the discharge of the ovum from the mature graafian follicle on about the thirteenth or fourteenth day of the cycle, counting from the first day of menstruation. According to older views, the ruptured follicle was filled with blood and soon underwent cicatrization and had no further function. We now know that the corpus luteum merely begins where the follicle leaves off and passes through a series of

developmental steps which convert it from a small, inconspicuous, collapsed structure to the large and brilliant yellow corpus luteum of tradition. The acme of development is reached just before the onset of menstruation.

Corpus luteum Cycle.—The developmental process of the corpus may be divided into the following stages:

1. Proliferation or hyperemia. This stage is marked by a continuation of the maturation changes in the follicle. The granulosa is well preserved and shows active proliferation, while the theca cells are large and polygonal, often

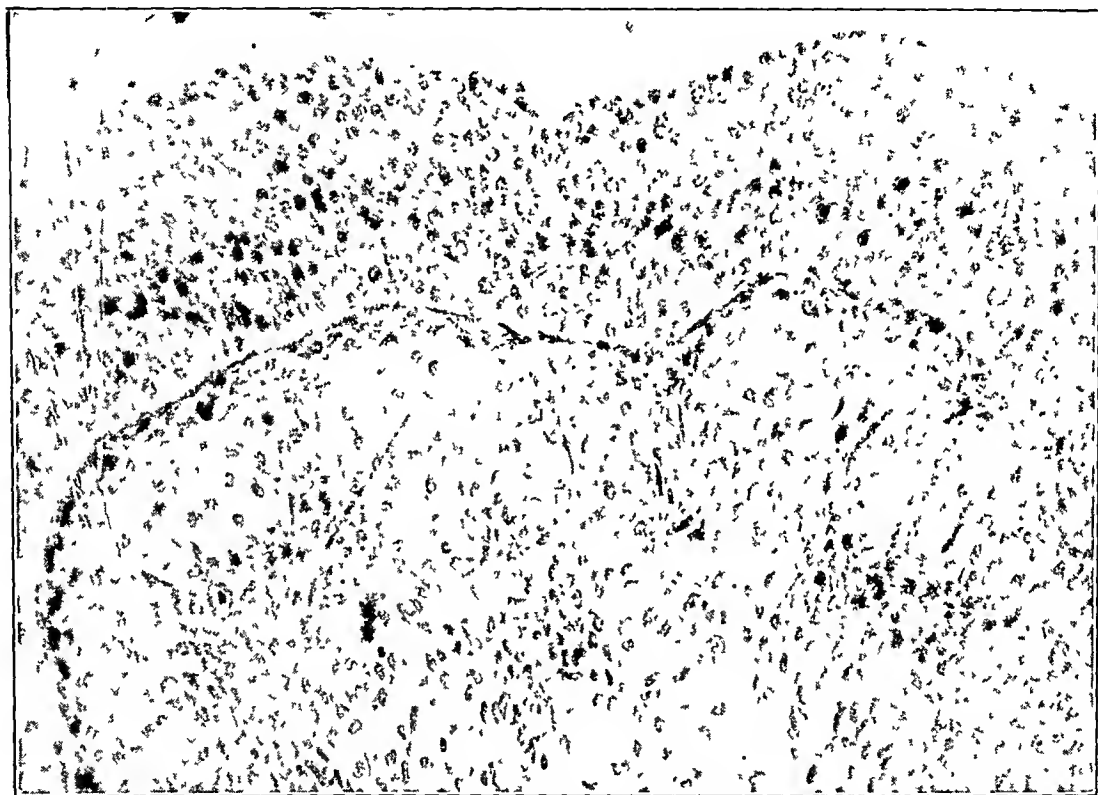


FIG. 106.—HIGH POWER PICTURE OF CORPUS LUTEUM SHOWN IN FIGURE 105.

containing fat globules; at this stage they look more like lutein cells than do those of the granulosa. Grossly, the wall of the corpus is grayish yellow with a slight undulation. There is usually but little or no hemorrhage into the cavity.

2. Vascularization. The granulosa cells have undergone gradual metaplasia, assuming lutein characters, while the theca cells have retrogressed. Blood channels from the theca have pushed into and irrigated the lutein layer with bleeding into the corpus cavity; as a rule of moderate degree in a zone within the lutein layer, it may, however, fill the cavity. At this stage the endometrium is in an interval phase.

3. Maturity. The corpus is a large yellow body 1 centimeter or even much more in diameter. The lutein zone is of a caroty yellow hue with much festooning. The cavity contains a little straw-colored fluid, often with a

considerable hemorrhagic admixture; at times the fluid content is abundant. Microscopically the yellow layer consists of the characteristic lutein cells, and at times the theca cells show marked hypertrophic changes (paralutein cells). A light layer of newly formed connective tissue lines the inner margin of the lutein zone. During this stage the endometrium is in the phase of premenstrual or pregravid hypertrophy.

4. Retrogression. With the onset of menstruation, retrogressive changes

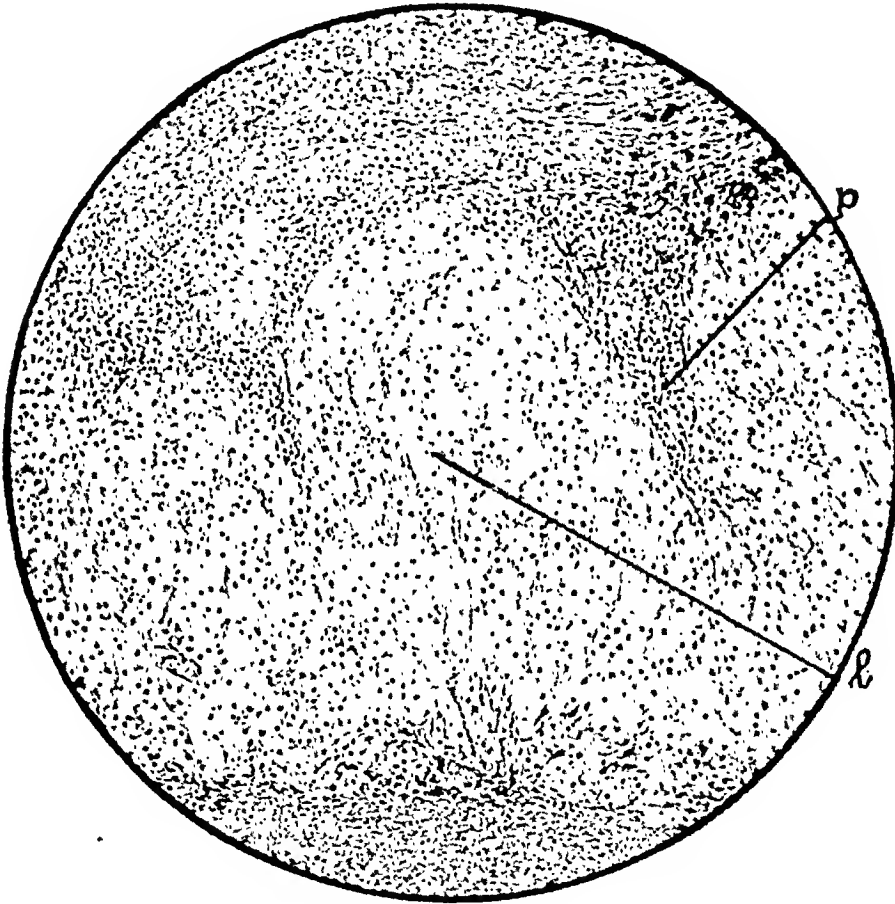


FIGURE 107.—WALL OF MATURE CORPUS LUTEUM, TWENTY-SEVENTH DAY (LOW POWER).

Showing lutein (*l*) and paralutein (*p*) cells. The latter are found in the wedgelike septa.

appear in the corpus luteum as the lutein cells become atrophic. Fibrosis and hyalinization soon convert the lutein zone into an amorphous convoluted hyaline ribbon sharply marked off from the connective-tissue core. This forms the end product of the corpus luteum, the so-called corpus albicans.

Corpus luteum of Pregnancy.—The corpus luteum of pregnancy (corpus luteum verum) exhibits the developmental changes of the mature corpus of menstruation (corpus luteum spurium) advanced to a greater degree, is larger, usually much more cystic, and with a broader zone of connective tissue within the lutein zone.

Atresia folliculi.—The process of atresia folliculi which has no known immediate relation to menstruation should be mentioned here. Although but one follicle matures each month, a number of others reach varying stages of development and become arrested in growth, presumably at the time of ovulation. The ovum in these blighted follicles dies, the granulosa degenerates and is cast off, and a small follicle cyst remains (cystic stage of atresia). Cicatrization then begins, and the cavity is gradually obliterated (obliterative stage) to form the corpus fibrosum.

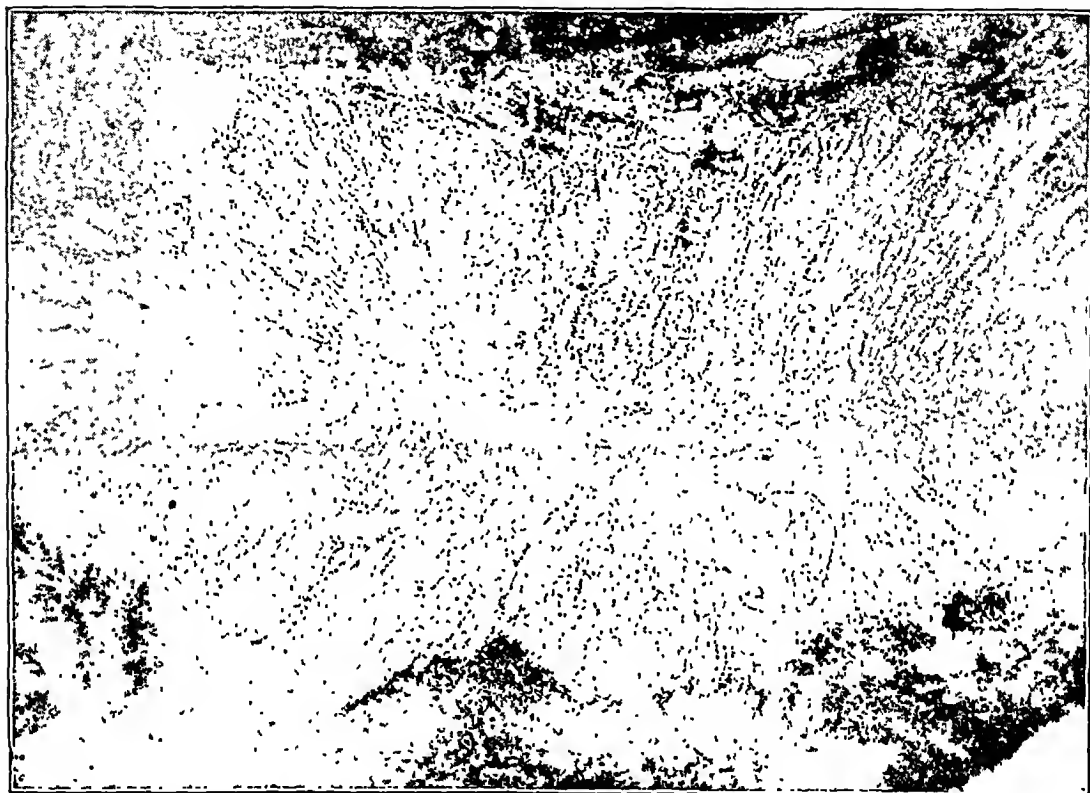


FIGURE 108.—CORPUS LUTEUM SHOWING BEGINNING OF RETROGRESSION (LOW POWER).

Menopause.—The *average menstrual life* of a woman extends over about thirty-two years, ceasing with the menopause ("change of life," climacterium, or climacteric). As with the menarche, there are wide individual variations in the age of the terminus. An exhaustive study by Sanes, based upon the literature of thirty-two nations, gives the average age as 47.1 years. In general, it seems true that women beginning to menstruate early, retain the function quite late, while a late puberty connotes earlier menopause. An active sexual life, with frequent childbirths, predisposes to a late menopause, according to Sanes. Other influential factors are heredity, social condition, obesity, general state of health, and pelvic disease.

Premature menopause occurring at an unusual age is pathological. For example, Kisch cites a fat Hungarian Jewess who began to menstruate at nine, married at fifteen, was sterile, and ceased to menstruate at seventeen. The

author has seen a number reaching the menopause in the early twenties, commonly of a type associated with obesity. In another group, the menopause occurred unusually late. A recent case menstruated regularly up to sixty and two years later came under observation for hemorrhages due to an adenocarcinoma of the fundus. A remarkable instance is reported by Batley of a woman menstruating regularly at ninety-three. Pitou's case is remarkable,

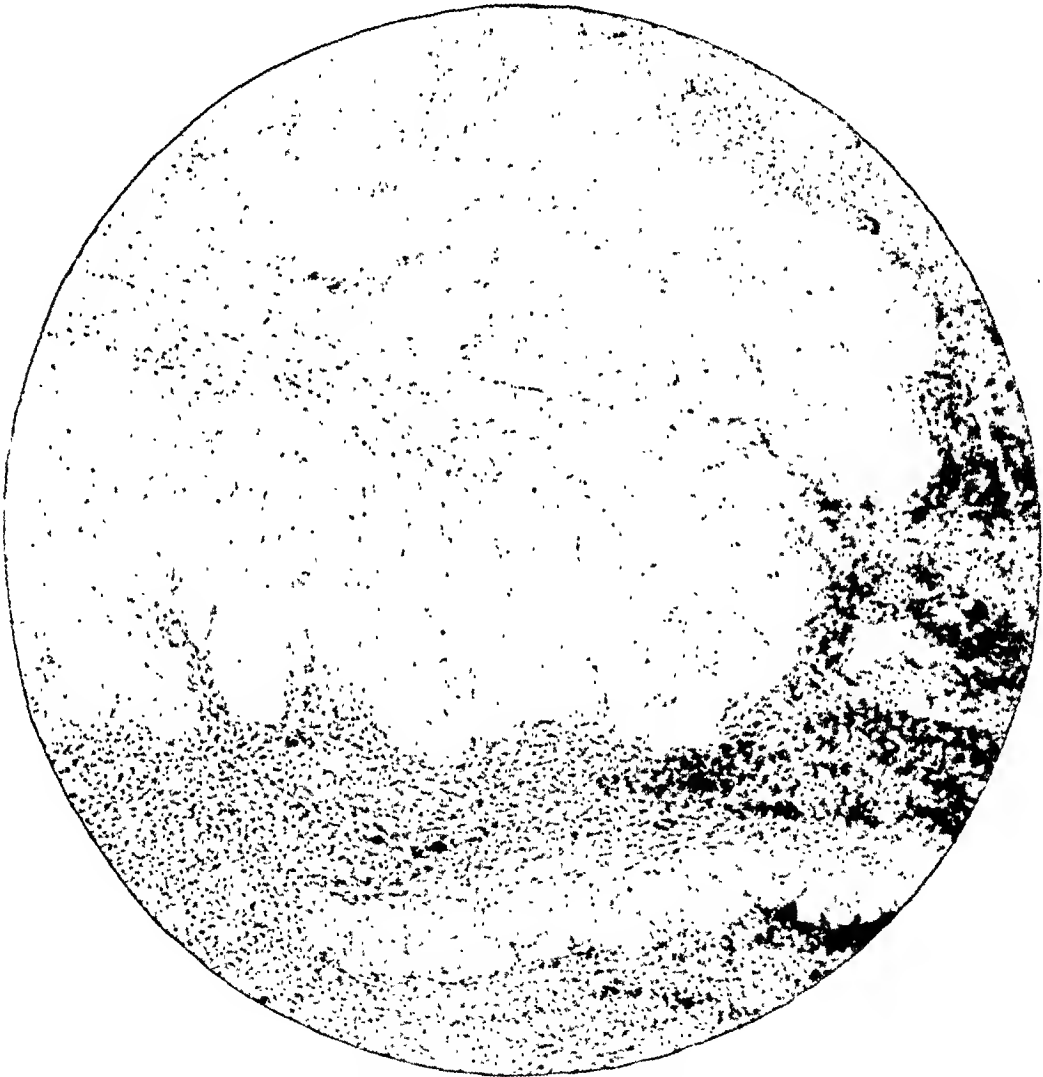


FIG. 109.—CORPUS ALBICANS.

Note sharp outline of hyalinized, festooned, lutein zone.

in that menstruation was regular for six months at seventy-two, when the woman became pregnant and aborted at the second month, the fetus being recovered.

The complete removal of the ovaries is of course followed by cessation of menstruation, and when it persists after such an operation, it is evidence that the extirpation was not complete. The impression is general that the surgical menopause is sharper and more severe in young women, justified by numerous

experiences a generation ago. In occasional instances, the effects of castration may be surprisingly slight. The sound surgical principle is that of the conservation of normal ovarian tissue.

The mere cessation of the function is but one of the *menopausal symptoms*. While the menopause is a normal epoch—the transition from a reproductive to a senescent period of life—it may at times present such distressing symptoms as to become pathological; particularly is this the case in women who approach it in poor physical and nervous health.

The phenomena observed are:

1. Cessation of menses. The menses disappear rather gradually; after an amenorrhea of one or two months, the flow appears for several months, then

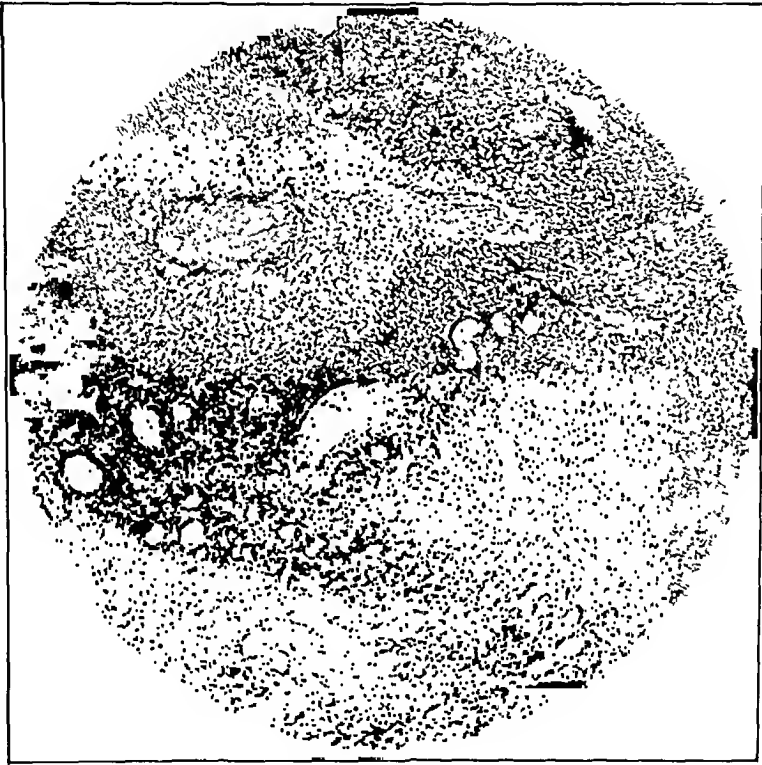


FIG. 110.—CYSTIC ATRETIC FOLLICLE UNDERGOING OBLITERATION (above and to left).

disappears, and so on with lengthening intervals until it ceases. Again, the disappearance is abrupt and final. The flow is less in amount as well as in frequency. Excessive bleeding is indicative of abnormality; although often functional rather than organic, it calls for investigation.

2. Vasomotor symptoms are the most characteristic of the subjective manifestations. Chief among them are flushes of the head and face, occurring in the more severe types twenty or more times a day, lasting from one to several minutes, and making life miserable. Associated with these, are more or less profuse sweats. Hot flushes involving the whole body may be troublesome. Other symptoms are vertigo, faintness, vicarious forms of bleeding, and cold extremities.

3. Nervous and psychic symptoms are headache, vertigo, irritability, and depression, with perhaps a distinct neurotic tendency. Many lay persons have exaggerated ideas of the rôle of the "change of life" in causing insanity.

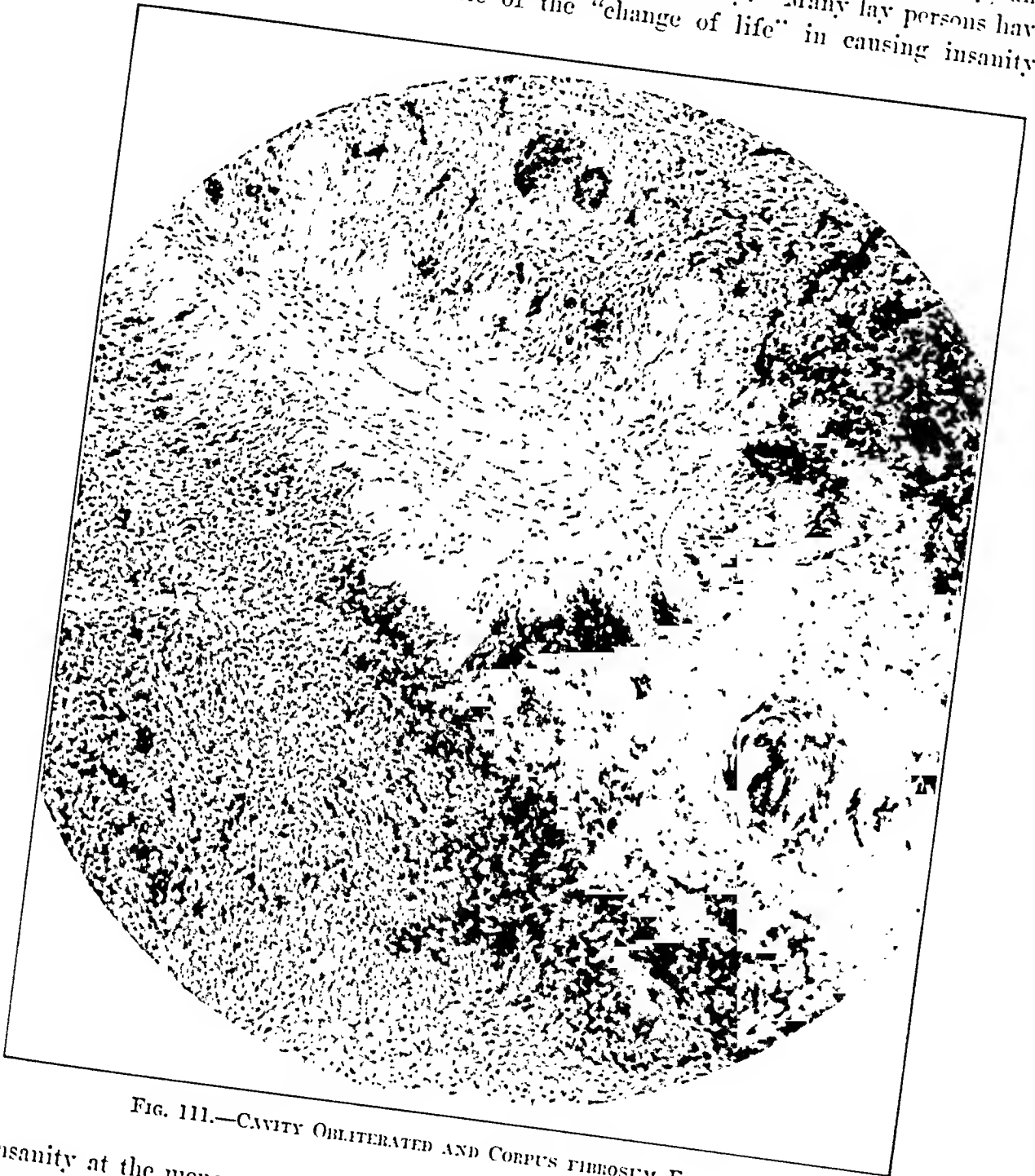


FIG. 111.—CAVITY OBLITERATED AND CORPUS FIBROSUM FORMED.

Insanity at the menopausal age is either a coincidence, or the menopause acts merely in a predisposing rôle as a period of undue stress. There is often a tendency to insomnia, and there are occasionally attacks of paroxysmal tachycardia and palpitation. Other symptoms are numbness, tingling, and pruritus.

4. Digestive disturbances are not infrequent and constipation is common,

diarrhea less so. The chief constitutional change is an increase in weight noted in at least one-half, when previously lean women become plump and matronly. The gland tissue of the breasts atrophies, while the breasts themselves may become larger from a deposit of fat. The vulva and vagina both show atrophic changes; the labia become flat and shriveled, while the mucosa becomes thin and pale. The uterus with the cervix undergoes atrophy, perhaps to half its former size. The tubes are thinner and shorter, and the ovaries are small, beady, and cirrhotic, and of a peachstone appearance from the repeated ovulations. Corpora lutea are no longer found, and such follicle remains as corpora albicantia and atretic follicles disappear in time. The cortex of the ovary becomes dense and sharply marked off from the medulla.

Treatment.—In many, the symptoms are so mild that no treatment is called for; some, however, need medical supervision for their various discomforts or distress. Aside from general hygienic measures, regulation of life, avoidance of worry, general reassurance, and increased rest, the treatment is largely symptomatic, although it is well in many to attempt more specific measures in the way of organotherapy for the relief of the characteristic vasomotor symptoms; indeed, it is to organotherapy alone that we look for aid. The preparations and methods are discussed under organotherapy.

AMENORRHEA

Amenorrhea is the absence of menstruation during the reproductive period of life. When menstruation fails to appear at the usual age in young girls, we speak of the amenorrhea as primary; when, on the other hand, menstruation fails to appear in women who previously have been menstruating more or less regularly, it is secondary.

There is nothing to show that an absence of the menstrual flow is *per se* inimical to health. On the other hand, there is no doubt sometimes a psychic effect due to a prolonged abeyance of the function; also, there is often lessened possibility of pregnancy. One often encounters the notion that the absence of menstruation causes the victim to "go into a decline," which means to become tuberculous. This springs from the well-established fact that tuberculosis does often itself cause an amenorrhea, reversing the causal relation.

Etiology.—It must be emphasized that the cause of pathological amenorrhea is only occasionally found in the pelvis, and that it is far more frequently constitutional. The reverse statement appertains to excessive menstruation. The chief causes are here discussed.

Local.—**Congenital Absence or Malformation in the Generative Apparatus.**—Absence of the uterus, frequently observed, is incompatible with menstruation, as is the congenital absence of both ovaries, so rare, however, as to be negligible. Congenital absence of the vagina

probably never occurs with a normal uterus, but a complete atresia of the canal, most frequently due to imperforate hymen, is not so rare. The result is a retention of the menstrual discharges, such cases being commonly by misnomer designated as amenorrheas: menstruation usually occurs with regularity but the blood is simply pent up above obstruction. A better designation is that of retained menses (cryptomenorrhea).

Acquired Pathological Lesions of Pelvic Organs.—Local pelvic lesions are far more apt to cause a menstrual excess than an amenorrhea. Occasionally, however, with a complete destruction or replacement of the ovarian tissue, as in bilateral ovarian carcinoma, dermoids, or other cysts, the lesion may bring about a castration as effectually as a surgeon's knife. Similarly, destruction or atrophy of the endometrium, as after a grave puerperal infection or an overvigorous curettage, may produce an amenorrhea.

General.—Physiological.—Amenorrhea is a characteristic accompaniment of pregnancy, although not infrequently a single period, and sometimes a number of periods, is noted after the onset. Some doubt these repeated bleedings as representative of a genuine menstruation. Lactation likewise is characterized by amenorrhea, although with many exceptions. Ehrenfest has shown that in at least 81.3 per cent of lactating women, menstruation appears sooner or later even while nursing. Amenorrhea, however, is the rule in the earlier months of lactation. The amenorrhea so often noted in the first year or two of the menstrual life or at the menopausal era ("dodging period" of puberty or the menopause) is normal.

Acute Infectious Diseases.—Many of the acute infections, especially of severe grade, exert a powerful inhibitory effect on menstruation, amenorrhea being often seen in sharp attacks of the acute exanthemata, pneumonia, and typhoid fever. Influenza is a notable exception, often bringing about an anticipatory or excessive period, as illustrated on a grand scale in the pandemic of 1918.

Chronic Debilitating Diseases.—Tuberculosis profoundly influences menstruation, so much so that it is important to remember that amenorrhea is at times one of its incipient symptoms, a careful examination in young patients seeking medical aid for an amenorrhea now and then revealing an early phthisis. Amenorrhea is more frequent in the advanced stages when it may represent one of nature's conservative efforts.

Likewise, the later stages of debilitating diseases, such as diabetes, nephritis, and the various anemias are often characterized by an amenorrhea. The importance of undernutrition as a cause must be stressed, as borne out by animal experiments showing the deleterious effects of a defective diet on ovulation. A gigantic experiment was that of the underfed women of the belligerent European nations, especially in Germany, where many papers appeared on the widely prevalent "Kriegsamenorrhoe."

Mental Diseases.—Amenorrhea is common in many insanities, especially in the depressive forms, including melancholia; when menstruation is present, it is apt to be scanty.

Functional Defects.—Most frequent and interesting are the amenorrheas due to a functional defect. While, broadly speaking, some of the causes already mentioned are functional, in the group now under discussion the disorder is much more obvious. Especially important are the disorders of the ductless glands. The commonest are the amenorrheas associated with more or less obesity, an association long recognized before its true nature was suspected. On the basis of animal experimentation and clinical observation, it is accepted that the adiposogenital dystrophies are due to an endocrinopathy involving chiefly the pituitary body. Some believe that the trouble is less in the hypophysis than in the adjacent brain areas; cases of this type are commonly designated as the hypopituitary or adiposogenital type (Fröhlich's syndrome). The distribution of the obesity is rather characteristic with its deposits about the shoulders and busts, the narrow waist, and the obese abdomen, hips, and buttocks. There is an occasional masculine type of hair distribution, especially pubic. The increase in weight, which may be enormous, is associated with scanty or absent menstrual periods.

Thyroid disease is sometimes associated with amenorrhea, more often from hyper- than hypo-thyroidism, with many exceptions.

Defective or absent ovarian function, following radiation, must be listed. It is possible that in other endocrinopathies, a secondary hypofunction of the ovaries may cause an amenorrhea.

Amenorrhea sometimes follows sudden or severe shock or fright or prolonged worry, as in a girl who fears an illegitimate pregnancy, or, on the other hand in the woman who longs for motherhood. Sudden chilling of the body or wetting of feet at times causes a suppression, more frequently operative when the flow has already started, thus constituting a suppression of menstruation rather than an amenorrhea.

Treatment.—An important part of the treatment is reassurance with the associated mental relief. General hygienic measures are of the utmost value: fresh air, good, appetizing food, rest, and exercise. A more direct treatment must depend upon a recognition of the cause. As one cleverly enunciated, "If the works are in good order, the clock will strike regularly." When due to the absence of uterus or ovaries, it is incurable. When the uterus is present but markedly hypoplastic (fetal type) it is likely to be permanent. In milder degrees of underdevelopment, with an irregular or scanty menstruation, improvement is possible through measures designed to promote the development of the uterus. Dilatation of the cervix is often resorted to, with the use of organ extracts, especially the pituitary (whole gland or anterior lobe), and various ovarian extracts. The results are poor, mostly nil.

When due to an acquired lesion of the pelvic organs or to systemic or mental

diseases, the treatment is, of course, that of the underlying cause: *e.g.*, by curing a tuberculosis, the general condition is improved. In anemia, the logical and safe emmenagogues are the indirect ones—the hematinics.

Probably the most interesting therapeutic type is in the ductless gland disorders, especially the common adiposogenital type associated with its obesity and discussed under organotherapy.

DYSMENORRHEA

Dysmenorrhea designates simply painful menstruation. Normally, the monthly function causes no actual pain beyond a slight sensation of lower abdominal heaviness.

Stanley Hall, opposed to the higher education of women, disseminated the idea that women ought to be interned in cubicles during the menstrual period to meditate upon the phenomenon, and George Engelmann's elaborate statistics showed from 80 to 85 per cent incapacitated by menstruation. Impressed by these data, our colleges, beginning with Vassar, appointed a woman supervisor of the students' health. Upon entrance, as many as one-third had had local examination and complained of backache. Carefully kept college statistics, however, soon revealed the futility and errors of the former reasonings; it was Mary Putnam Jacobi who, in her Boylston Prize Essay, 1876, on "The Question of Rest for Women during Menstruation," went so far as to say that rest at the monthly period was even unfavorable to health.

Further readjustments have been noted, particularly since the advent of women into medicine, who concur, in general, in the opinion that the greatest change in young women is not due to any change in fashions—witness the spike heels of to-day and the present vogue of fashionable slenderness—but because of their decidedly healthier mental attitude toward their sex and its problems.

There is no reduction in physical force in menstruation and the notion of an increased risk of catching cold is readily negated by the present extreme tenuity of dress.

Perhaps the most influential factor in fostering a "chronic dysmenorrhea," particularly among college or boarding-school girls, is the too-common recurrent sympathy. A hypodermic of water has often proved a great and an illuminating help with these psychoneurotics. Once out of college, the incapacity becomes more rare!

Cardiovascular changes during the menstrual period have been investigated by Jessie L. King (*Am. J. Physiol.*, 1914, 34), the basal metabolism by Katherine Blount (*J. Biol. Chem.*, March, 1926), and the excitability of the nervous system by Leta Hollingsworth; all agree that there is no notable relationship between the phenomena. Margaret Sturgis (*J. Indust. Hygiene*, June, 1923), reviewed 2,077 women in industry, using for analysis Elizabeth Van

Duyné's bases for studying the students at Goucher College, and found the same true of women in industry.

Lilian Welsh, long-time professor of physiology at Goucher College, is in entire accord with the more modern views of her colleagues expressed here.

Clelia D. Mosher of Stanford University and Florence L. Meredith, Medical Examiner, Wellesley College, and formerly physician in charge of women employees, Hood Rubber Company, have given particular attention to the hygiene of women. The latter concludes, "Mental hygiene and general hygiene, including general and special exercise, seem to be the treatment of choice in most cases of menstrual disturbances in young girls, and in many cases in older women. A large proportion of such disturbances are due to faulty muscular development and faulty circulation within the power of the individual to correct" (*Surg., Gynec., & Obst.*, 1920, 31).

Unquestionably, then, regular normal occupations and the engendering of a healthier mental attitude tend greatly to lessen complaints.

There are, however, individuals not normal, who are in reality medical or surgical cases, perhaps of a toxic type.

The pain at menstruation in a pathological case may be extremely severe, utterly incapacitating the sufferer as long as the flow lasts. Such pains are commonly associated with some demonstrable pelvic lesion, such as an inflammatory or a neoplastic disease. Here the dysmenorrhea is secondary. In the primary essential type, there is an absence of any gross recognizable pelvic lesion. As a rule, these pains are intermittent, colicky, and laborlike, and are spoken of as spasmodic dysmenorrhea. In the secondary form, it is oftener heavy and bearing down, constituting the type of congestive dysmenorrhea.

Any general condition of lowered resistance predisposes to dysmenorrhea. Here we classify the severe dysmenorrheas in girls depleted by overwork, lack of sleep, or improper hygiene; in this group, when the faults are corrected, the pain disappears. The various anemias and especially chlorosis are important here. The latter disease, as many have noted, is becoming much less common. Tuberculosis likewise has been credited with an especial importance in the production of dysmenorrhea. In this type, improvement or disappearance of the trouble often follows improvement in health.

Etiology of Primary Dysmenorrhea.—Primary dysmenorrhea is one of the commonest disorders; in the aggregate it probably causes more suffering than any other gynecological ailment. We are still in the dark as to its cause and mechanism; three theories have been offered:

Mechanical Obstruction of the Uterine Canal.—A well-known paper by J. Marion Sims bearing the title "Nulla dysmenorrhea nisi obstructiva," indicated how firmly convinced the earlier gynecologists were as to this causal factor. The theory dates as far back as 1832 to Mackintosh who reported a series relieved by dilating the uterus. For years, ante flexion of the uterus was held to be a common cause because of the obstruction due to the kink at the

angle of flexion. The evidence against this notion is at last convincing, as it has been shown that even in severe dysmenorrheas a sound can often easily be passed into the uterus. In actual genital obstruction, as with gynatresia, the pain is rarely of the spasmodic type. Regarding the supposed causal relation between antelexion and dysmenorrhea, it is well to remember that there are varying degrees of antelexion in nearly one-half of all nulliparæ, that a sharp antelexion is often found without any menstrual pain, and that in many severe dysmenorrheas there is not the slightest antelexion. The relations between these two conditions were well summarized in a paper by Herman in 1910.

In a few instances, pathological conditions do actually obstruct the menstrual blood with consequent pain, causing a secondary dysmenorrhea; for example, a ball valve fibroid polyp may produce it and must always be borne in mind, especially when the uterus seems somewhat enlarged and when the pains have come on after earlier years of ease. The amount of flow is apt to be increased.

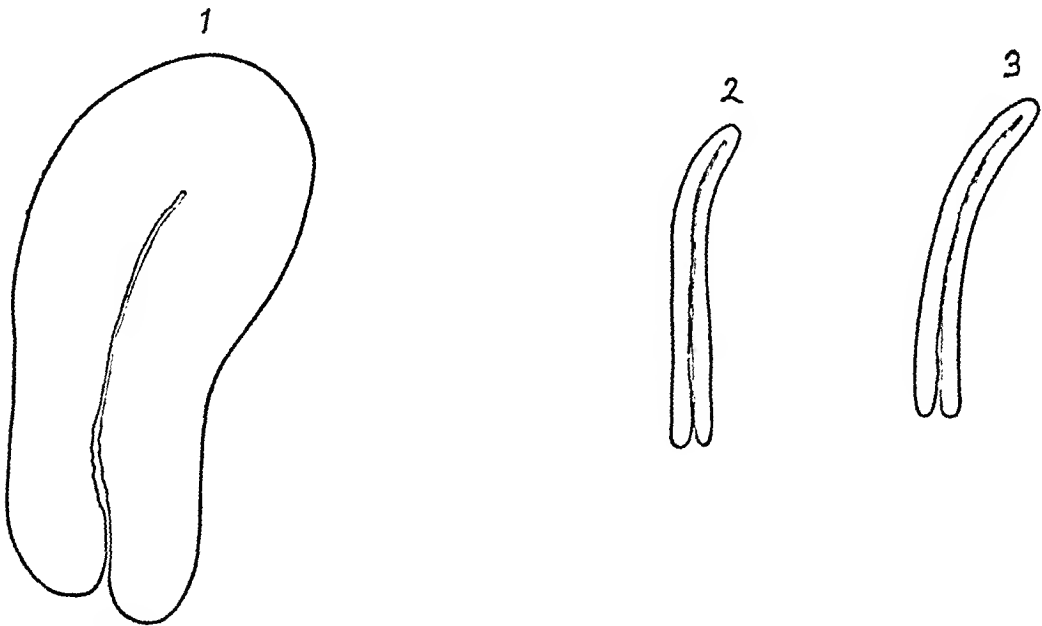


FIG. 112.—FETAL TYPE OF UTERINE HYPOPLASIA (UTERUS RUDIMENTARIUS OR FETALIS) (2 AND 3), AS COMPARED WITH NORMALLY DEVELOPED UTERUS (1).

Neurosis.—In many, there is a strong neurotic factor. When the threshold for pain is greatly lowered, a stimulus barely noticed in the normal woman is magnified into actual pain. In such there are other accompanying nervous symptoms and not infrequently a hysteria.

Hypoplasia of the Organs.—There is an inclination in recent years to put more stress on this factor as a cause of the primary type. In a uterus of an infantile type, we find frequently amenorrhea or oligomenorrhea, and sometimes dysmenorrhea, but it is in the far commoner hypoplasias of mild degree (uterus subpubescens) that dysmenorrhea is most marked. These various

grades with their clinical characteristics were studied by Novak (*J. Am. M. Ass.*, 1918, 71).

As to the mechanism of the pain here, no positive statement can be hazarded; the immediate cause is presumably a spasmodic muscular contrac-

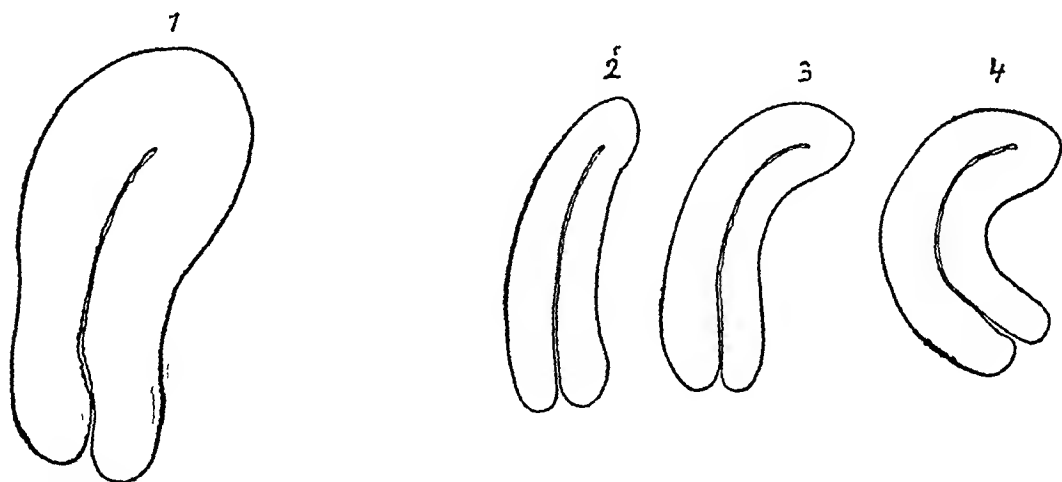


FIG. 113.—TYPES OF INFANTILE UTERI (2, 3, AND 4), IN COMPARISON WITH THE NORMAL UTERUS (1).

In all the cervix predominates over the corpus. In 3 is a moderate corporeal anteflexion, while 4 illustrates the more characteristic cervicocorporeal anteflexion. In some cases the cervix is normal, in others long and conical, with pinhole os. Uteri of infantile type may be of practically normal size or considerably smaller.

tion explained by some as due to vascular defects or to an abnormal disproportion between muscular and fibrous elements. Inasmuch as the endometrium here undergoes the premenstrual swelling as in the normal uterus, it would seem that there might be too little room for expansion, evoking ex-

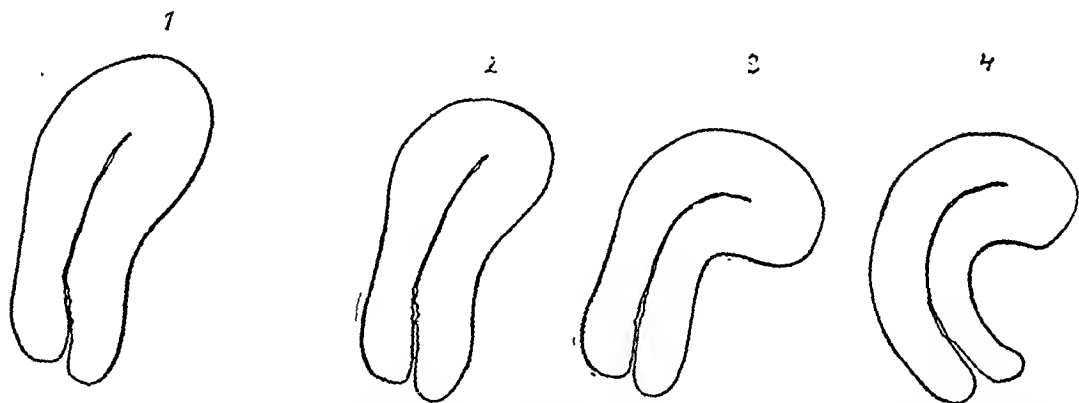


FIG. 114.—TYPES OF SUBPUBESCENT UTERI, SHOWING ONLY SLIGHT DIFFERENCES IN SIZE FROM NORMAL UTERUS (1).

In 2, 3, and 4 are shown, respectively, corporeal and cervicocorporeal anteflexion.

pulsive efforts. This seems plausible as this type of dysmenorrhea diminishes or disappears with the establishment of the flow, usually on the first or second day.

Etiology of Secondary Dysmenorrhea.—Almost any well-recognized form of pelvic disease may be associated with dysmenorrhea. Most important are

pelvic inflammatory diseases, neoplasms, and uterine displacements, especially retroflexion and retroversion. The individual factor in determining the degree of pain is great. It is surprising to note how little pain there often is when pelvic disease is extensive. Again, another woman may suffer excruciating pains associated with a small submucous or interstitial myoma. Of the groups of most important causes mentioned above, G. Holden found, in a series of one thousand cases in the gynecological wards at the Johns Hopkins Hospital, that retrodisplacements were associated with dysmenorrhea in 41 per cent, pelvic inflammatory disease in 37 per cent, and uterine myoma in 11 per cent, the 11 per cent remaining being divided among various less frequent affections.

Treatment.—Treatment is directed either to relief during the attack or to permanent relief.

Relief during Attack.—**General Measures.**—Of general measures, except in the milder grades, rest in bed is of the utmost importance and usually resorted to by the patient of her own volition. When mild, the rest for a few hours is often all that is needed. If more severe, the bowels should be well evacuated and a hot-water bag applied to the lower abdomen.

Drugs.—The drugs used in treatment have been legion, among the most valuable being the several coal-tar derivatives, phenacetin, acetanilid, and antipyrin, phenacetin perhaps being the most desirable because least depressing. In using such remedies, attention must be given to the condition of the heart, combining caffeine with the analgesic. One of the following prescriptions will often prove serviceable:

℞ Acetphen. 5 i
Caff. grs. vi
Sod. bicarb. q.s. 5 ii
M. et div. in chart. no. xii
Sig. One powder with water every three hours.

℞ Acetanil. grs. xv
Caff. grs. viiss.
M. et div. in caps. no. xv.
Sig. One capsule every three hours.

Closely allied to these tar derivatives are aspirin (acidum acetylsalicylic) and pyramidon (dimethylaminantipyrin); the former, in tablet form, 5 grains every four hours, pyramidon, in capsules, 3 to 6 grains every four hours.

When the pain is too severe, add small doses of codein to the above, as:

℞ Acetanil. grs. xv
Caff. grs. viiss.
Codein. sulph. grs. iii
M. et div. in caps. no. xv.
Sig. One capsule every three or four hours.

According to Matthews Duncan, the best drug is guaiacum, given 10 grains three times a day, beginning a week before the onset of menstruation.

The two most efficacious drugs are so dangerous that they should rarely, if ever, be used. We refer to morphin and alcohol, the administration being very apt to induce the habit of regular use, especially when the occasion arises regularly. Rarely, where the cramps are intense, opium may be given guardedly, as recommended by Hirst:

R	Tr. opii camph.	5	i
	Tr. zingib.	5	i
	Sp. chlorof.	5	ii
	Syr. acac.	5	ss.
	Aq. menth. pip. q.s. ad.	5	iv

M.

Sig. One tablespoonful when required for cramps.

Such a prescription ought not to be released to the patient to be renewed p. r. n.

We have often had quick results from belladonna, in a suppository of half a grain of the extract, or from the extract of opium, quarter of a grain, combined with the belladonna.

When the nervous symptoms are most marked, it is well to resort to the bromids, but owing to their mildness, they need the addition of some more decidedly analgesic drug.

We have used with effect, at the onset, a warm enema of say 6 ounces, slowly given in an empty bowel, containing 30 to 40 grains of sodium bromid.

Many vegetable drugs have been credited with efficacy in relieving dysmenorrhea, such as viburnum, prunifolium, apiol, and helonin. It is clear, however, that their pharmacologic action is nil. Sundry proprietary mixtures containing these drugs have had considerable vogue, owing their "virtue" (?) to the considerable amount of alcohol ingested.

The drug we have found best, in this type, is atropin, which diminishes the irritability of the autonomic uterine nerve-endings. Its use should begin two or three days before menstruation, to be continued until the second or third day of the flow, depending on the usual duration of the pain. The ordinary dose is about $\frac{1}{120}$ grain every four hours. Patients differ in their tolerance, so it should be given to the point of saturation, as determined by the dryness of the throat or a slight disturbance of accommodation or flushing of the cheeks. Atropin often relieves where the other drugs have failed.

Recently, Macht and others have lauded the use of benzyl benzoate as an antispasmodic, but our own experience is disappointing, the results not comparing with atropin. When benzyl benzoate is given in an alcoholic solution or with the aromatic elixir of eriodictyon (Litzenberg) to disguise the bad taste, the dose is 1 or 2 drams every four hours.

Permanent Relief.—The many plans of treatment advocated indicate that no one is eminently successful. This applies especially to primary dysmenor-

rhea which remains as a crux in gynecology. The resort to hysterectomy at times reveals the desperate straits of the gynecologist. The treatment of the two types of dysmenorrhea is different and they will be considered separately.

Primary Dysmenorrhea.—The physiological cure is pregnancy; it is well-known that this practically always overcomes the primary dysmenorrhea. Even without pregnancy, marriage sometimes brings great relief. Unfortunately, however, it cannot be prescribed as readily as a drug.

1. Rapid dilatation of the cervix still remains the most popular method of treating this type of dysmenorrhea, being based primarily upon the notion that the dysmenorrhea is obstructive. While the theory is incorrect, as so often happens the remedy is often efficacious, (*a*) giving a marked temporary relief, (*b*) taking the edge off the pain and making it bearable, (*c*) giving occasionally complete permanent relief, (*d*) giving no relief at all.

There is no logic in combining the dilatation with a curettage of the uterus apart from any special indication. If, however, there is the slightest reason to suspect a possible small intra-uterine tumor, the cervix should be expanded and the interior explored with sound and polyp forceps.

There is an increasing tendency to abandon the older parallel blade dilators of the Goodell-Ellinger type for the Hegar series of dilators, graduated say from 5 millimeters up to 15 or 20, as affording a better dilatation of the internal os uteri.

Holden analyzed the reports of ninety-five patients, covering a period of from one to twelve years after dilatation and curettage for dysmenorrhea, and found that 40 per cent were entirely or greatly relieved for at least one year, with a recurrence after a year or more in 7 per cent. Thirty per cent experienced no relief at all, while the remaining 30 per cent had but slight relief or relief for a few months only. Marked maldevelopment was present in twenty cases, only 25 per cent of which were relieved.

2. Dilatation of the cervix is sometimes combined with the continuous dilatation by use of an intra-uterine stem-pessary, the theory being that the pessary stimulates contractions and promotes the development of the uterus. The use of such a pessary is not without definite risk, even of an ascending infection. It most frequently takes the form of an endocervicitis with a persistent discharge, but it may even provoke a pelvic cellulitis or salpingitis. If it is used at all, the patient should be carefully watched and the pessary removed at the slightest hint of trouble.

3. Plastic operations on the cervix have been recommended by Sims, Dudley, and Pozzi for the relief of a supposed cervical stenosis, but experience fails to confirm their value. Done by inexperienced operators, these plastic operations have frequently left the patient with a cervix in such a bad condition as to prevent her carrying a pregnancy to term.

Secondary Dysmenorrhea.—The permanent relief of this form depends upon the removal or correction of the causative pelvic factor: the

removal of a myoma, of an ovarian cyst, or of a pyosalpinx, or, again, the correction of a retrodisplacement. The technique is discussed in other chapters.

In extreme forms where not infrequently the patient is little more than a semi-invalid chained down to this function, either suffering unbearably or spending one or two weeks getting over it or racked by the menses a week or more in advance of the onset, where in the past surgeons have been tempted to remove the ovaries, or the uterus, the treatment of the utmost value is to check, or at times to stop the menstrual period several years, by radium or x-ray (Chapter XLIV). The aggravated "incurables" of this group offer from time to time the best results obtainable from ray therapy.

Membranous Dysmenorrhea.—Membranous dysmenorrhea is a rare form, usually severe and cramplike, with the passage of large or small pieces of membrane with the discharges. The membrane may be expelled on the first day, but it more frequently comes away on the second or third with great expulsive pains and sometimes in a single piece. There can be but little doubt that this represents an exaggerated phase of the normal menstrual process, the superficial layers of the endometrium ordinarily being cast off in small portions undergoing autolysis or degeneration. When the entire superficial endometrium is thrown off, it resembles that sometimes seen in an ectopic pregnancy. There is considerable individual variation in the amount of the endometrium thrown off.

The treatment is unsatisfactory. Curettage does not help. When severe, the use of radium is indicated to check or stop the flow.

"Nasal Dysmenorrhea."—In 1893, Fliess called attention to "nasal dysmenorrhea," the biological connection between the reproductive organs and the nose having long been known. He described two areas in the nose, designating them as the genital spots, stating that during menstruation they are swollen and hypersensitive. In many, he declared that the dysmenorrhea could be relieved by a simple cocaineization of these spots. While his results have been verified in observations by Schiff, Linder, Mayer, and Brettauer, it is likely that the results were largely due to suggestion as apparently shown in a report by Kuttner. The cocaineization in some of these cases is first tried as a test, then, if positive, according to Mayer and Brettauer, more permanent relief secured by treating the genital spots at intervals with trichloroacetic acid. The matter remains *sub judice*.

INTERMENSTRUAL PAIN

Intermenstrual pain is a relatively infrequent pain, occurring regularly at a fairly fixed date between two menstrual periods. The term "intermenstrual pain" was first used by Sir William O. Priestly. In Germany, it is commonly known as "Mittelschmerz." The pain may be either dull and aching, sharp, or depressing, and is referred to the lower abdomen. It lasts a few

hours or even several days and is frequently accompanied by a slight vaginal discharge, usually of a leukorrheal character. There is usually nothing peculiar in the menstrual history or the pelvic findings. Nothing is known of the etiology except that it would seem that it may in some way be associated with ovulation, occurring normally about this time. Treatment is not satisfactory. If marked enough, it should be managed like a dysmenorrhea.

CHAPTER VIII

UTERINE HEMORRHAGE

HOWARD A. KELLY

ETIOLOGY

1. Functional

MENARCHE
CHLOROSIS
MENOPAUSE
BLOOD DYSCRASIAE

2. Organic

FOCAL INFECTIONS
RUPTURED HYMEN
HYPERPLASTIC ENDOMETRIUM
TUBERCULOUS ENDOMETRIUM
POLYPS, CERVICAL AND INTRA-UTERINE
SUBMUCOUS FIBROMA
FIBROID TUMOR OF THE UTERUS; ADENOMYOMA
CARCINOMA
SARCOMA
ABORTION AND PLACENTAL POLYP
EXTRA-UTERINE PREGNANCY
SALPINGITIS
SENILE VAGINITIS
SYPHILIS

TREATMENT

Temporary
Drugs
Hygienic Measures
Curettage
Radium
X-Ray
Surgical

Many gynecological diagnoses are made by proceeding from a particular symptom and investigating and excluding one by one the various diseases likely to give rise to such a symptom until either by exclusion or by direct discovery of the cause the diagnosis is made.

Hemorrhage is a symptom common to a number of gynecological affections, which, always demanding a thorough investigation until the cause is manifest, may be either trifling—as in the old with a desquamative vaginitis—or more marked, even leading to an aplastic anemia and condition of the bones. This

latter degree of hemorrhage is also associated with early cancer and with fibroid tumors of the uterus. Excessive losses may also characterize a more advanced cancer, large fibroid polypi, and myoma, when it has even proven fatal. In miscarriages, the bloody discharge is apt to appear in spurts and with the discharge of clots. It is likewise excessive in hydatid moles, in submucous polypi, especially those seeking to escape by the cervix, and in some sarcomata.

Because a periodical discharge of blood from the vagina, from menarche to menopause, is natural to women, and the amount lost is subject to variations, the possibly serious significance of a hemorrhage is often overlooked and investigation postponed until too late to intervene successfully. This applies with particular force to the menopausal period when irregularities and a marked degree of variation in the flow is expected and commonly regarded as natural. A serious obstacle lies in the ever ready assurance of older women that the expected is happening as they recall others who were worse and recovered nicely.

In affirming that a woman has hemorrhages, we postulate a norm from which she varies. There is, however, no ideal fixed norm, except in so far as experience has established an individual average monthly quantum. As women measure these things, one or two absorbent napkins a day during a period lasting from three to five days, lessening toward its termination, is an approximate standard; there are, however, those of plethoric habit who always regularly flow much more freely, while others are habitually scanty. Again, there is the standard of health; if the monthly flow seems too free and is weakening or causes anemia, it calls for investigation.

Etiology.—Bleeding cases may be divided generally into functional and organic. The functional are often due to disturbed ovarian secretion or may depend upon some dyscrasia, such as hemophilia, purpura, or chlorosis. An unrecognized syphilis is often responsible for serious hemorrhages relieved entirely and only relievably by appropriate antisyphilitic treatment. Focal infections in remote parts must always be considered and investigated. The organic causes are malignant growths of the vagina or uterus, tumors of the uterus and ovaries, abortion, and pelvic inflammatory disease, as well as cysts of the corpora lutea.

The effort to locate the source and cause of a hemorrhage calls for a direct examination of all the pelvic organs in the justifiable hope of finding the lesion at some point or points between the vaginal outlet and the ovaries. Conspicuous exceptions to this rule of a discoverable local lesion are the myopathic hemorrhages of a severe, intractable type, due to changes in the uterine musculature with endarteritis; here nothing appears but an occasional enlarged uterus. The diagnosis "myopathia uterina" is made by exclusion.

In examining a patient, one must bear in mind all possible causes of hemorrhage.

1. *Functional*.—M e n a r c h e.—There are marked variations at the change of life within physiological limits; for example, the intervals become irregular and may be characterized by excessive fluxes. If a thorough investigation reveals no demonstrable lesion, the treatments should be palliative always, with rest and regulated bowel function and suspension of undue exercise, avoiding tire and sometimes even study; it may last for a period of several months or a year or more.

C h l o r o s i s.—The prolonged, excessive, pale, exhausting flow of chlorosis appears in the menarchal period and demands careful treatment—rest judiciously combined with fresh air, emptying of the low alimentary tract, and the administration of iron with arsenic.

If a continuous excessive flow becomes alarming in the young, an examination becomes obviously imperative made in the *virgo intacta* under an anesthetic in order both to spare the feelings and to secure the complete relaxation necessary to a satisfactory bimanual recto-abdominal exploration of the pelvis. It rarely becomes necessary to rupture the hymen, in conformity with a salutary dictum of the ancients, "*Magnum est crimen perrumpere virginis hymen.*" It is to the credit of the Jews that of all people they still feel most strongly on this head (Deut. 22: 14, 17).

M e n o p a u s e.—Among the varied phenomena of the menopause are the expected irregularities in the menstrual function. Suffice it to say briefly here that any marked deviation from the customary amount of flow ought to be investigated carefully by a searching local examination, including always a curettage. Aside from systemic causes, we have several local factors to consider; namely, the liability of the cervix and body of the uterus to cancer, the possibility of uterine fibroids or polyps of the cervix and of the body, changes in the myometrium producing what are called for want of a better name myopathic hemorrhages, and tumors lateral to the uterus. The prime object of such an examination is always to discover or to exclude cancer.

B l o o d D y s c r a s i æ.¹—Faulty blood coagulation causes hemorrhage, particularly the oozing type. Whenever bleeding from the smaller vessels becomes difficult to control, the coagulation time of the blood *in vitro* should be ascertained. A simple method is to draw 5 to 6 c.c. of blood from the arm into a Keidal tube to compare with the mean time of normals taken under the same conditions, which on the average should not exceed ten minutes. This procedure is capable of universal application and is probably as accurate as the more refined methods where much smaller volumes are involved. If the coagulation time is too long or the clot too weak, one of the coagulation factors is at fault. There are three factors in blood coagulation: (1) Fibrinogen, converted to fibrin by thrombin; (2) prothrombin, converted to thrombin by the action of the ionized calcium and tissue extracts; and (3) blood calcium.

¹ Contributed by Fred. West, Howard A. Kelly Hospital.

Laboratory tests for thrombin and calcium salts in the serum of the clot will furnish all the data necessary, for if both thrombin and calcium are normal, then there must be a lack of fibrinogen (for which we have no test) in the original blood. This, however, is a very rare phenomenon; usually there is either a low thrombin content or a calcium deficiency. Bleeding due to faulty coagulation can usually be stopped by any of the commercial forms of thrombin injected subcutaneously, but, where a real calcium deficiency exists, this is only a temporary expedient and means must be taken to promote the assimilation of calcium, as for example, a diet rich in calcium salts—green vegetables, farinaceous foods, buttermilk. Salt should be used sparingly and calcium lactate taken by mouth. Good results will usually be obtained by taking 5 grams of calcium lactate daily for three weeks, then, alternating weekly, one week on

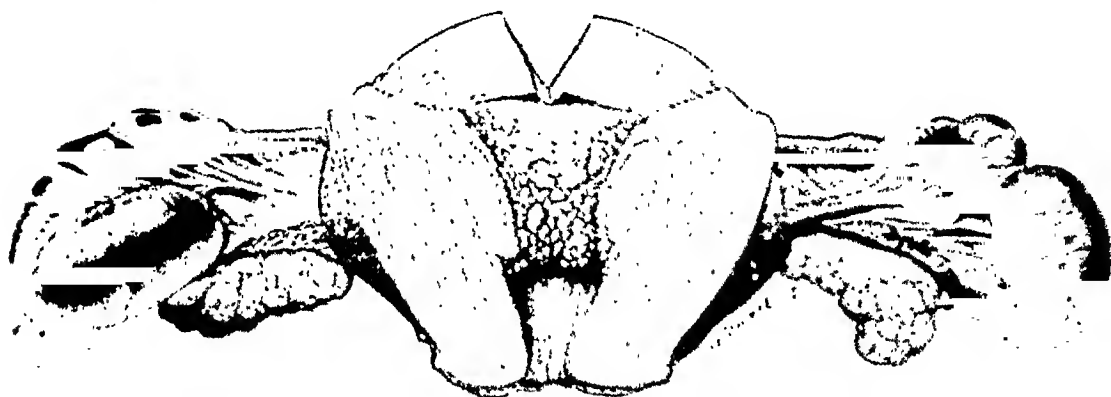


FIG. 115.—POLYPOID "ENDOMETRITIS," SHOWING EXTENSIVE PAPILLARY OVERGROWTH OF UTERINE MUCOSA. (T. S. Cullen.)

calcium and one week off, as long as necessary. Five grams—a level teaspoonful—should be dissolved in a glass of hot water, and one-third taken at breakfast, lunch, and supper. Daily mild exposure of the body to ultraviolet rays is very beneficial in promoting calcium absorption.

Calcium deficiency may be temporary after heavy bleeding or chronic as in faulty metabolism. A word of caution about transfusions is not amiss. One must always remember that the excess of sodium citrate used to prevent coagulation of the donor's blood binds its equivalent of the recipient's blood calcium and thus aggravates the calcium deficiency unless calcium therapy is instituted simultaneously. The minimum of citrate necessary to prevent coagulation should not, therefore, be exceeded, especially when we transfuse for calcium deficiency.

2. *Organic.*—*Focal Infections.*—Focal infections in remote parts, such as the mouth, tonsils, teeth, and sinuses, are from time to time responsible for serious menstrual hemorrhages. Attention to this sometimes results in an entire clearing up of the trouble when no other cause is discoverable. They are of especial importance in the young.

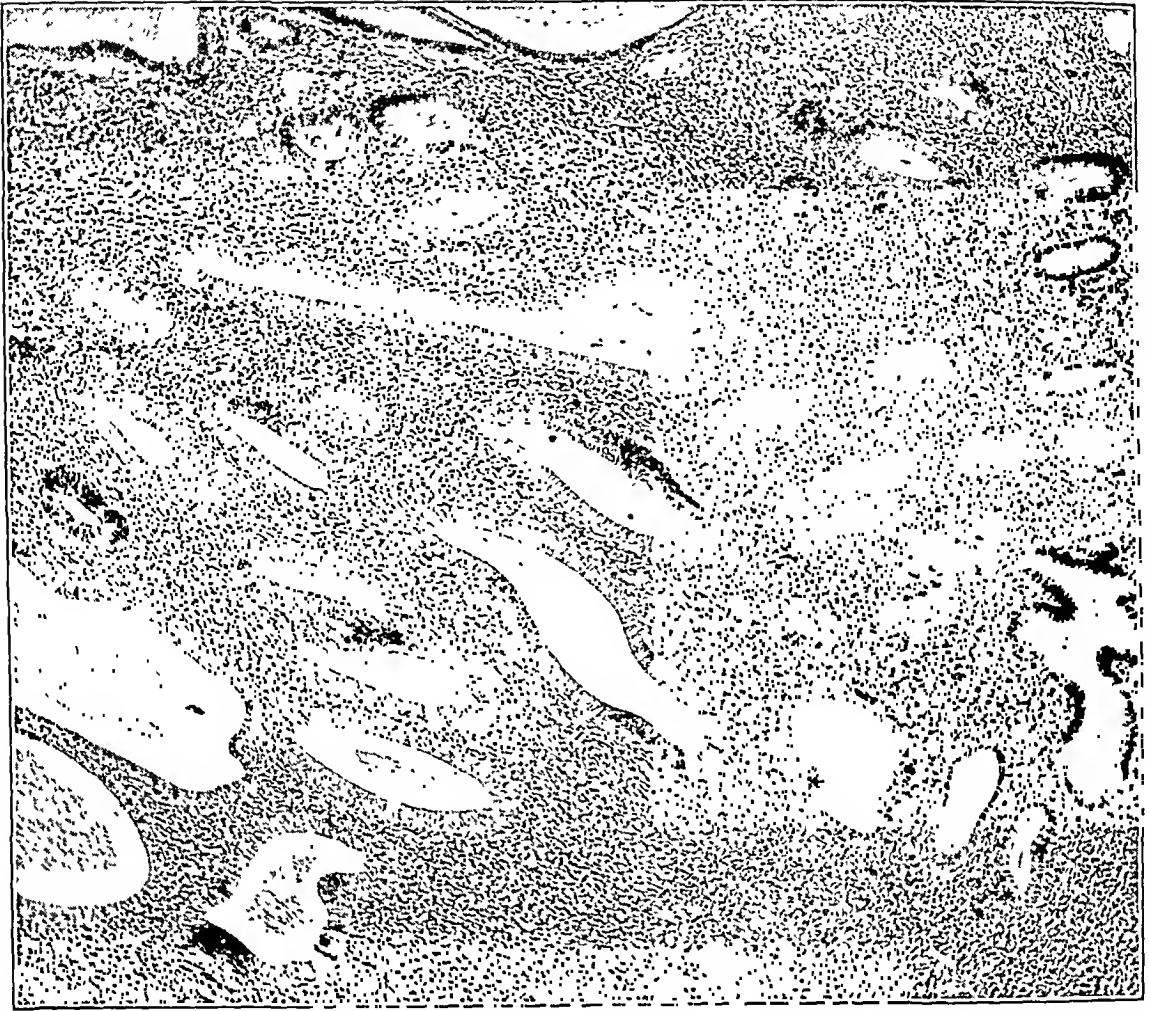


FIG. 116.—TYPICAL ENDOMETRIAL HYPERPLASIA CONSISTING OF A HEAVY STROMA IN WHICH LIES IRREGULAR "SWISS CHEESE" PATTERN OF GLANDS LINED BY A HEAVY EPITHELIUM.

Note absence of all signs of infection. Mitoses often present in stroma not visible under this magnification. (J. H. U., Gyn.) $\times 180$.

One girl of sixteen was curetted twice for excessive and prolonged menstruation with marked secondary anemia, with temporary benefit. Ray therapy was then considered. On the advice of a consultant, the mouth was examined and infected tonsils found and removed. Following this, the first menstruation was somewhat excessive, but thereafter normal. While removal of diseased tonsils by no means cures all cases, this focus must be borne in mind. In older women, infections of the teeth need special consideration.

Ruptured Hymen.—In rare instances, the ruptured hymen of the newly wedded bleeds enough to call for operative interference. The cause, as well as the cure by a clamp and a suture, is obvious and easy.

Hyperplastic Endometrium.—Hemorrhages and a protracted menstrual period are sometimes due to an excessive overgrowth of the endometrium, either as shown in Figure 115 or in long acuminate tufts filling the uterine cavity, a condition erroneously labeled endometritis by our predecessors

and not to be mistaken for the physiological phases of growth and desquamation. This form is oftenest found in women near forty when there is apt to be good reason from the history to suspect an adenocarcinoma of the body. Until the advent of radium, its sovereign cure, it was my custom in extreme cases in younger women to curette systematically and thoroughly after one or two days of free menstrual flow, a method yielding excellent results though not curative.

Tuberculous Endometrium.—Some irregular bleeding, a curettage yielding scant endometrium, and the microscopic discovery of tubercles occasionally reveal an unsuspected lesion which may or may not be associated with characteristic hardened or nodular tubal isthmi.

Polyps, Cervical and Intra-uterine.—In a fairly large gynecological practice, one is not infrequently rewarded by discovering a uterine polyp as soon as the speculum is introduced, offering a brilliant opportunity to illustrate the old adage, "*tolle causam et tollitur effectus.*" The treatment is either to grasp the growth, if it is a small one, with a polyp forceps and twist until it comes off, or to use electric high frequency desiccation, destroying it readily *in situ*. Larger polyps call for circumspection on account of the risk of hemorrhage. Here the removal ought to be done in a hospital where the cervical canal can be dilated and a soft tumor easily extracted, and the patient packed firmly if necessary to check the hemorrhage which is, however, usually moderate. A larger fibroid polyp may even call for a free anterior incision up into the uterine body.



FIG. 117.—HYPERPLASTIC "ENDOMETRITIS." SECTION OF POLYPOID ENDOMETRIUM AS UNDERLYING MUSCULARIS; FROM NEAR MIDDLE OF UTERINE CAVITY.

Note redundant mucosa dependent toward cervix. Surface of polyp covered by one layer of epithelium. Stroma abundant. Round-celled infiltration. (T. S. Cullen.)

GYNECOLOGY

The uterine mucosa should next be investigated, after enlarging the cervical canal with the Goodell-Ellinger or Hegar dilators for the introduction of a curet and a polyp forceps. A sound measures the depth of the uterus; if it is over 7 centimeters, a cause for the increase must be discovered. One notes any hemorrhage from the contact with the fundus. A polyp forceps is used to examine the interior of the uterus, step by step opening and closing and making little tentative tractions. A soft polyp is always easily grasped

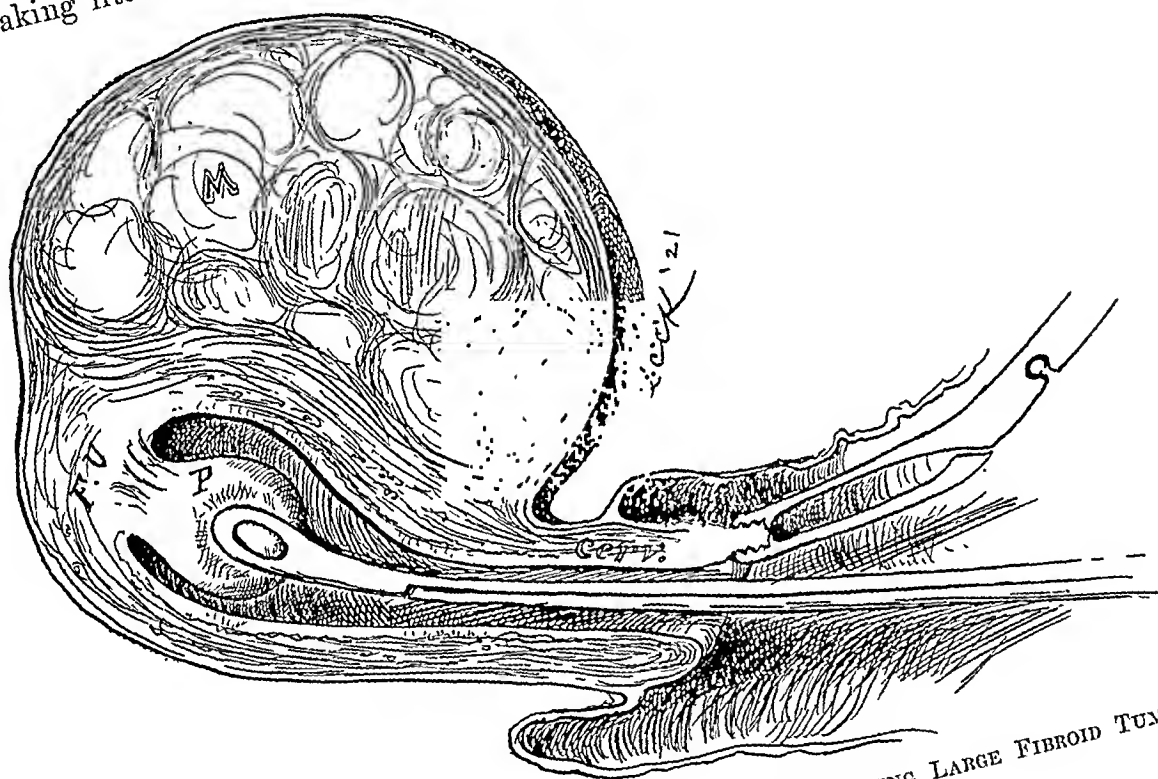


FIG. 118.—POLYP CAUSING HEMORRHAGE IN UTERUS HARBORING LARGE FIBROID TUMOR.
Removal of polyp relieves hemorrhage.

and twisted and removed. Even though large fibroid tumors are noted, it is sometimes the case that a mucous polyp, 2 or 3 centimeters long, or a pedunculate fibroid tumor is the real and efficient cause of the hemorrhages, Figure 118. The recognition of this fact may obviate a radical operation. Larger fibroid polyps are recognized when grasped in the wide spread of the forceps, Figure 120. A little rotation effort shows whether or not there is a well-defined pedicle. It is wiser to do this operation in a hospital and watch the patient for a while to avoid the danger of a hemorrhage. In one of my patients, back in the eighties in Kensington, Philadelphia, I sewed the cervix up with silkworm gut and checked a severe hemorrhage.

After the polyp forceps, use a curet with extreme gentleness to ascertain the condition of the walls of the uterus and avoid a perforation while securing

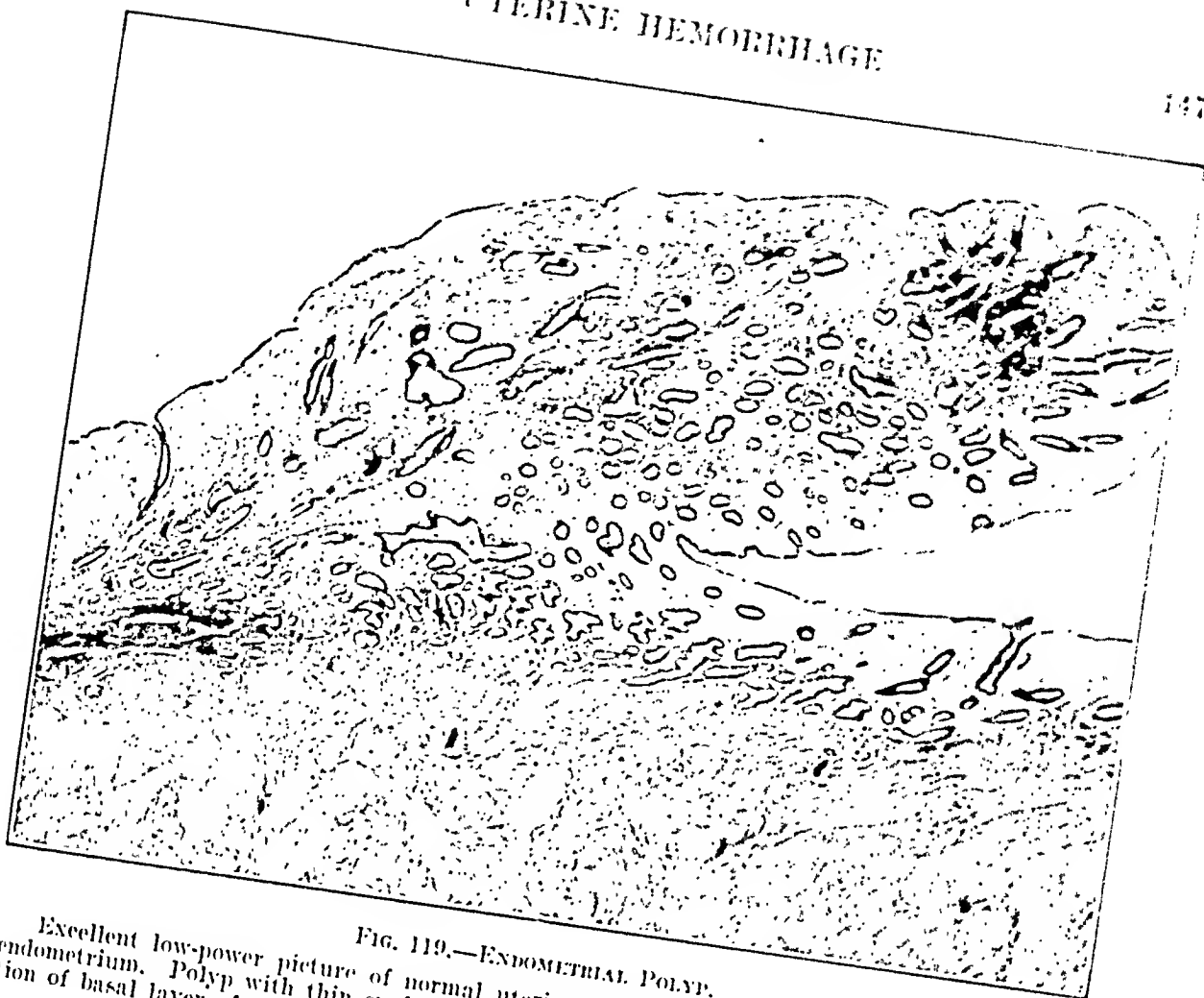


FIG. 119.—ENDOMETRIAL POLYP.

Excellent low-power picture of normal uterine musculature below layer of thin interval endometrium. Polyp with thin surface covering of epithelium, interior resembling a herniation of basal layer of endometrium. (J. H. U., Gyn.) $\times 10$.

endometrium for examination; a cure may be effected by thoroughly cleaning out any abundant flabby endometrium.

Submucous Fibroma.—A submucous fibroma, causing excessive and protracted hemorrhages, presenting at the external os which is more or less dilated or through which it can be felt, is not common. It is to be distinguished from a polyp by its broad base as outlined with a uterine sound. I include here by arbitrary classification tumors of this group up to a baseball in size. Such growths are liable to necrobiosis, sloughing, hemorrhages, and foul exhausting discharges, and are sometimes the cause of a terminal blood infection.

In the absence of any infection, if symptoms are not urgent, heavy radiation may be tried out over a period of several months. If this does not stop the hemorrhages and reduce the growth an operation should be resorted to.

A sloughing tumor, more or less easily accessible through the external os, is best treated by the ablation of such parts as are accessible and yield readily to traction with a stout placental forceps. If the os cervicis is wide open, pieces can be grasped and clipped away by scissors until there is more room

in the uterine cavity for the free escape of the discharges. If the patient is profoundly infected, it is usually best not to anesthetize but to remove the tumor piecemeal in several sittings, using strong saline (4 to 5 per cent) irrigations in the intervals or a warm continuous irrigation.

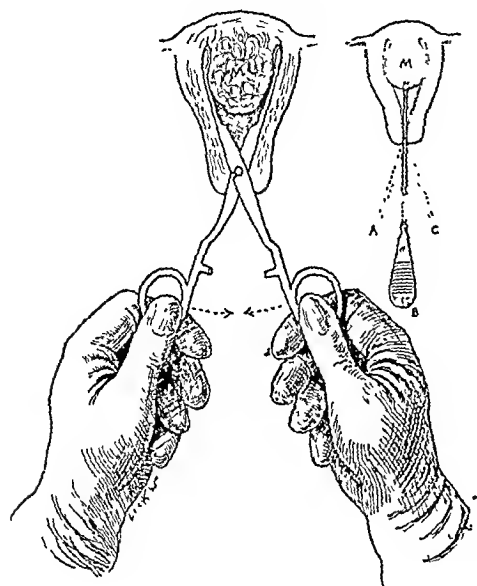


FIG. 120.—METHOD OF ESTIMATING PRESENCE OF AND GRASPING A SUBMUCOUS POLYP PRELIMINARY TO TORSION FOR ITS REMOVAL.

Right-hand smaller figure is method of estimating presence and size of a fibroid polyp by the uterine sound in three positions.

m. myoma; *a*, *b*, *c*, sound in three positions estimating size and attachment of pedicle.

If there is no sloughing and the field is clean, and the examination reveals other tumors in the uterine body, it is best to operate, removing the whole through the abdomen.

A single lesser growth can be extirpated from below by doing a formal vaginal operation surrounded by all due antiseptic precautions. It is vitally important in each case to assure oneself by a thorough bimanual examination that the tumor is not an inversion of the uterus, by noting the presence of the body of the uterus above it. In removing a submucous tumor, one must also remember that there may be a partial inversion. An accident here is avoided by bisection.

With the patient in the lithotomy posture, the cervix is grasped by a Jacobs forceps and detached from the anterior vaginal wall by a semicircular incision. The bladder is then separated as far up as the peritoneal reflexion. The cervix is

now grasped with two tenaculum forceps and, Figure 121, split between them up into the uterine cavity, widely exposing the tumor which is removed by repeated wedge-shaped excisions until it begins to collapse, when each side of the tumor is grasped and drawn down and out as far as possible. It is now completely bisected through as far as the loose tissue investing its opposite periphery. From this point of vantage, both halves are shelled out. The bed of the tumor is examined for hemorrhage to be checked by suture, and the cervical incision is closed with catgut and the vaginal vault reunited. Leave a drain or pack in the uterus if there is any more than slight hemorrhage and keep the patient in bed for a few days.

Fibroid Tumor of the Uterus; Adenomyoma.—A bimanual examination, always under an anesthetic when necessary for complete relaxation, reveals any fibroid tumors and need not be dwelt upon here further than to remark that one must ever bear in mind the not infrequent association of an adenocarcinoma or sarcoma of the body. Mistakes here are so serious and so fatal in their consequences that the exclusion of both of these compli-

eating conditions becomes one of the important objectives in the investigation of fibroid nteri. It is generally stated that 2 per cent of all fibroid tumors are thus malignant. If we exclude the nonhemorrhagic fibroids (a large group) and confine our statistical studies to the bleeding tumors, the percentage of malignancy will be much higher.

The adenomyomatous type of tumor is characterized by excessive prolonged periods associated with unusual pain and tenderness. Aside from this latter characteristic, it is hardly distinguishable from the common fibroid growth, diagnoses being made as a rule after removal.

C a r c i n o m a.—Common causes of irregular hemorrhage in middle life and later are cancer of the cervix and of the body of the uterus and complicating fibroid tumors. The cervical cancer is usually obvious at once in the friable, often foul, easily bleeding, fungating, or more or less ulcerated and excavated cervix. A ragged orifice is always suspicious and often yields abundant tissue if scraped within with a small curet.

A site of the cancer causing hemorrhages, often overlooked, is within the cervix which externally appears normal. Any cervical tissue yielding to the curet is almost certainly malignant.

S a r c o m a.—This is one of the rarer causes of hemorrhages, usually affecting the uterine mucosa or arising by metaplasia in a myoma. The hemorrhages are irregular, free, and protracted; the abundance of material removed justifies a suspicion confirmed by the microscope. I have seen one case of a tumor not over 2 centimeters in diameter discovered by enretage.

A b o r t i o n a n d P l a c e n t a l P o l y p.—In married women, threatened or incomplete abortion must always be suspected as the cause of

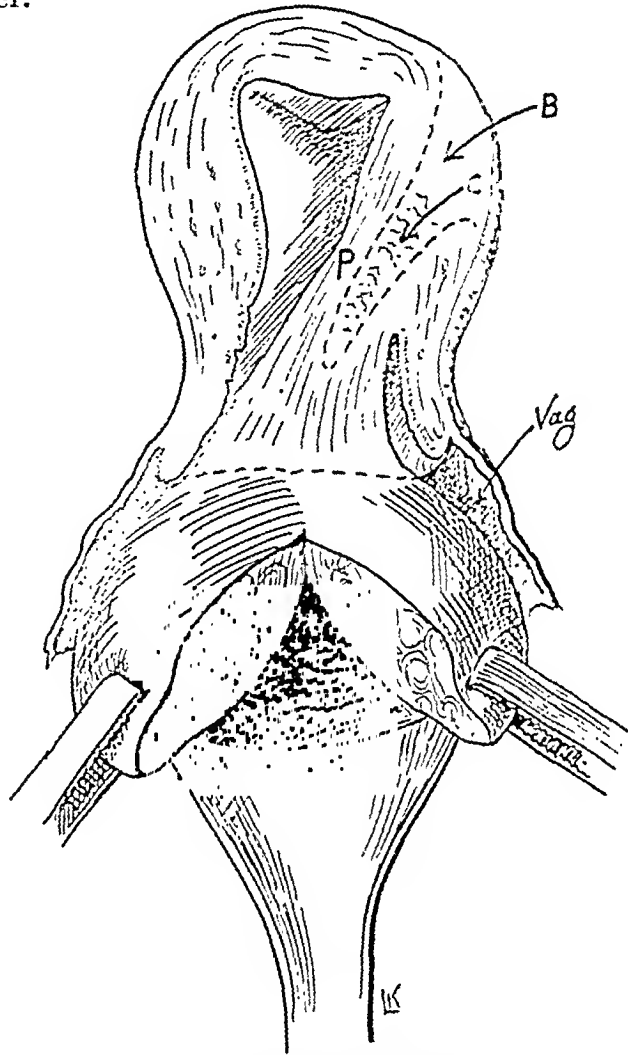


FIG. 121.—BISECTION OF SUBMUCOUS MYOMA SHOWING AVOIDANCE OF PERITONEAL INVERSION INTO ITS PEDICLE.

Sketch from memory of specimen seen in collection of Werth of Kiel in 1888.

P, pedicle; B, inverted peritoneum; C, peritoneal adhesions.

a menorrhagia until its existence is disproved, thus avoiding mortifying mistakes.

The leading symptoms indicating a threatened abortion are pains due to uterine contraction, loss of blood, and as a rule an enlarged more or less boggy uterus; the discharge not usually profuse at first may be dirty brown or consist of fresh red blood and coagula. A premonitory bleeding may hang on irregularly for weeks or even months, or it may terminate shortly in the expulsion of

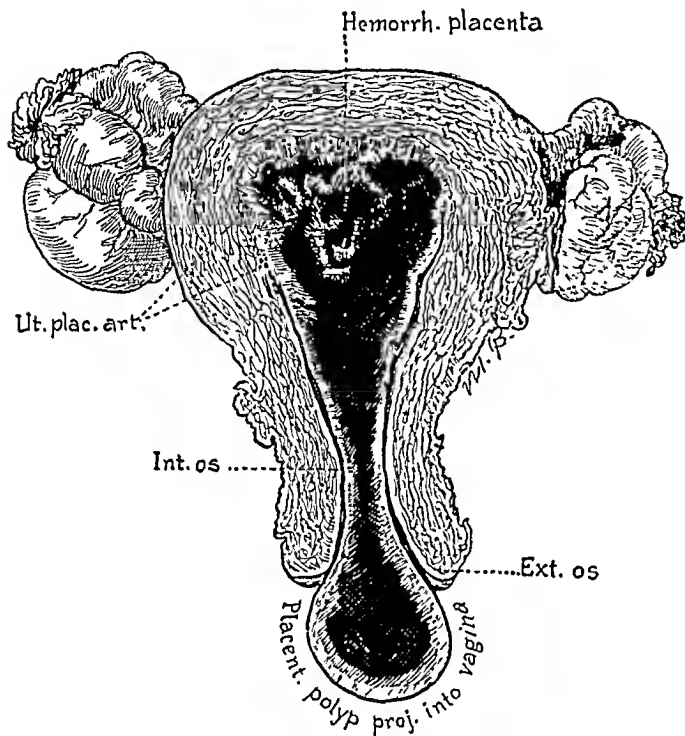


FIG. 122.—PLACENTAL POLYP, PRODUCT OF INCOMPLETE ABORTION, FORMED BY CONTRACTIONS OF UTERUS ACTING ON HEMORRHAGE TAKING PLACE SLOWLY AT PLACENTAL SITE. (Bumm.)

the ovum. The diagnosis must be made from the history of a missed period and the presence of some uterine enlargement. Sometimes, the pregnancy is too early to be suspected until the curettage is made. Little villous threads and dark coagula are characteristically interspersed through the fleshy masses. If there is any doubt, the microscope will settle it.

Part of the long-retained fetal elements and clots become welded together and molded into conformity with the uterine cavity to form a placental polyp, Figure 122, while the placenta, still hanging on to the uterine

wall, becomes coated with layers of old coagula until it hangs down into and out of the cervix, a rounded, somewhat pedunculate, polypoid mass.

Extra-uterine Pregnancy.—Irregular hemorrhagic discharges are characteristic of extra-uterine pregnancy, which may prove misleading if suspicions are not at once aroused by the significant history of amenorrhea, sudden and severe lower abdominal swelling and tenderness, anemia, and the often decisive bimanual examination. Curettage here often yields a typical decidua (see Chapter V).

Salpingitis.—It is quite common in salpingitis to elicit a history of excessive menstrual flow. Here the examination reveals the lateral mass or masses and the localized tenderness on one or both sides at the vaginal vault; it may be associated with a febrile reaction. The hemorrhage is rarely threatening and must be treated symptomatically as a part of the serious lateral intra-pelvic disease.

Senile Vaginitis.—Senile vaginitis will be suspected when a woman well past the menopause fears cancer because of some slight "spotting" of blood noticed on one or two occasions. Here, too, one must carefully exclude cancer of the cervix or body, while not failing to recognize the adherent surfaces and the denuded epithelium at the vaginal vault. Frequently, the upper vagina is more or less partitioned off by a false septum above which secretions accumulate giving rise to a vaginitis with pus and blood. The amount, usually scant, is sometimes fairly free. A 3 per cent silver nitrate solution should be applied, followed by a mild cleansing with treatments at intervals of several weeks until the surface heals.

Syphilis.—The general routine physical examination and the Wassermann reaction reveal syphilis as a cause of hemorrhage which may be checked by the appropriate antisyphilitic treatment.

Treatment.—*Temporary.*—To stop an active hemorrhage temporarily, put the patient in the Sims or knee-chest posture and apply a pack large and firm enough to make pressure against the vaginal vault; this should be renewed within twelve or twenty-four hours.

The use of *drugs* to check uterine hemorrhages, practically the one resource of our forefathers, is for the most part futile. Ergot, ingested in the past by thousands of tons, is useless. Pituitrin in ampules of 1 c.c., given one a day hypodermically, sometimes seems to check the bleeding of fibroid tumors; usually the first treatment is effective. Hypodermies of corpus luteum are sometimes of value in functional bleeding cases where there is no demonstrable lesion.

Hygienic measures are of the highest importance. Rest is the first step to take; some women bleed only when they are much on their feet or overtired. An empty bowel relieves local congestion.

Curettage is invaluable when the bleeding is uterine (Chapter V).

Radium is a valuable recourse in pelvic inflammatory diseases and in myopathic uteri is almost a specific, as well as in hyperplastic endometrium and in cancer of the body of the cervix. *X-ray* may here be considered an equal alternative with radium (Chapter XLV).

Operation is brilliantly successful in the inflammatory group not otherwise relievable, in the fibroid tumors, in cases of uterine polyps, in cancer of the body and cervix, and in endometrial pelvic tumors.

CHAPTER IX

ENDOCRINOLOGY AND ORGANOTHERAPY

EMIL NOVAK

ENDOCRINOLOGY

Amenorrhea
Functional Uterine Bleeding
Dysmenorrhea
Sterility

ORGANOTHERAPY

Functional Amenorrhea, Especially in Association with Adiposogenital Dystrophy
Uterine Hemorrhage
Dysmenorrhea and Genital Hypoplasia
Menopausal Vasomotor Symptoms
Sterility
Obesity of Hypogenital Origin
Other Alleged Indications
Conclusion

ENDOCRINOLOGY

Many of our gynecological patients present endocrine disturbances, the endocrinopathy sometimes dominating the picture both etiologically and symptomatically, particularly in those menstrual disorders which are but manifestations of internal secretory disturbances. Here we shall deal only with the group in which gynecology and endocrinology come into closer contact.

The great functions of the generative organs are profoundly influenced by disorders of the ductless glands, especially menstruation which is clearly due to an internal ovarian secretion directly related to the ductless gland apparatus. Although the ovary is considered the cause of menstruation, it is merely the portal—the point of contact—through which the entire endocrine system influences the generative organs.

Amenorrhea.—Although the majority of menstrual disorders are due to some uterine or adnexal anatomical lesion, a few undoubtedly arise from internal secretory disturbances, notably that form observed in connection with the well-known adiposogenital dystrophy. Fröhlich's syndrome—principally characterized by adiposity and sexual hypoplasia with amenorrhea—is often met and was well recognized even in pioneer days. We know from the researches of H. Cushing and others that these symptoms spring from hypopituitarism. Some

would locate the disorder in an area adjacent to the pituitary, but amenorrhea of this type is, nevertheless, commonly designated as hypophyseal.

The adiposogenital syndrome thus furnishes a striking example of the intimate relationship between the links of the endocrine chain. One would hardly on other than purely empirical grounds associate the pituitary body with the menstrual function or look to hypopituitarism to give rise to an amenorrhea. Since the ovarian hormone is the immediate cause of menstruation, the ovary is obviously the intermediary of the hypopituitarism; more explicitly, it would seem, theoretically, that hypopituitarism entails a deficient activity of the ovarian secretion normally effective in producing menstruation.

Functional Uterine Bleeding.—Of endocrine origin also is the "functional" uterine hemorrhage, a symptom which, while most frequent at the extremes of menstrual life, may occur at any age. A careful examination may reveal normal pelvic organs, and yet the bleeding may persist, often profusely, commonly assuming the form of menorrhagia rather than metrorrhagia. The first thought is curettage which at the climacteric may be urgent in order to exclude carcinoma. In the nonmalignant at the climacteric and at puberty, the report in the past usually has been "normal endometrium," "hypertrophic glandular endometritis," "chronic endometritis," and it has been difficult to incriminate the endometrium. Equally unsatisfactory were the efforts to explain the hemorrhages by a localized uterine arteriosclerosis or "insufficiencia uteri" (Theilhaber). The endometrium most commonly conforms to the type described by Cullen as hyperplasia, and the histological picture is characteristic.

The discovery of such a definite structural change as hyperplasia might well appear to remove the case from the category, "functional hemorrhage"; there is good reason to believe, however, that the hyperplasia is not a primary lesion but a sequel to the disturbed ovarian function, for normally, the endometrium is undoubtedly subordinate to the ovary. The ever changing histology of the uterine mucosa in the varying phases of the menstrual cycle is clearly a response to corresponding cyclical variations in the ovary, more especially in the corpus luteum. There is, therefore, nothing revolutionary in the notion that the hyperplasia is but a response to a definite endocrine ovarian disturbance.

Hyperplasia is generally observed only during reproductive life, while ovarian activity lasts, which is suggestive of an ovarian influence. Furthermore, the curettage treatment of hyperplasia is usually unsuccessful, whereas if it were only a local lesion, its removal ought to effect a cure; it is, therefore, reasonable to refer this common ailment tentatively at least to an endocrine disturbance. Radium and x-ray are effective by their destructive action on the ovarian follicles.

There is evidence that nearly all uterine hemorrhages, except those due to destructive lesions, are functional in the sense that the bleeding may be attributed to disturbances of the ovarian function as a result of pelvic disease, whether myoma, pyosalpinx, or other lesion. In other words, the simple con-

gestion associated with these ailments is not sufficient to explain the menstrual excess often noted, which we can better attribute to ovarian hyperfunction. The observant gynecologist will, therefore, always consider the pathological physiology of the ovary as he investigates the causes of uterine bleeding.

Menstrual disorders, including uterine bleeding, are common in derangements of the thyroid. There is doubt whether excessive menstruation is more likely to be associated with hyper- or hypo-thyroidism. Novak's experience leads to the belief that while either is possible, hemorrhage is commoner in deficient thyroid function; this is supported by Hertoghe and Selrt, the latter reporting that in fifty-five cases of functional hemorrhage, he found indications of hypothyroidism in thirty-eight. The other elements in the endocrine chain—the pituitary, thymus, suprarenal, etc.—may also at times give rise to uterine bleeding and other menstrual disorders, but our knowledge is imperfect here.

Dysmenorrhea.—Dysmenorrhea due to endocrinopathy is much less frequent and harder to demonstrate than amenorrhea or menorrhagia. But one somewhat indirect illustration suggests itself, that of a spasmodic dysmenorrhea, so common a cause of suffering and invalidism in young nulliparæ. The underlying condition is, very often, uterine hypoplasia of a fetal, infantile, or subpubescent type, as classified by the writer. It occurs oftener in the mild subpubescent type than in the fetal or rudimentary uterus; in the latter, amenorrhea predominates. Dysmenorrhea in a young unmarried woman with an underdeveloped uterus relates itself to the endocrine apparatus by the fact that disorders of the latter are responsible for the uterine hypoplasia. This knowledge should direct us in seeking more satisfactory methods of treatment, as undeniably our results to-day, whether by drugs, simple dilatation, the use of stem-pessaries, or plastic cervical operations, evoke but little enthusiasm. The same slur rests even more forcibly upon our organotherapy, where the fault lies not so much with our logic as with the nebulous nature of our knowledge of the endocrine nexus, as well as with our methods of preparing gland extracts.

Sterility.—Much of the above applies also to the type of sterility which is associated with uterine hypoplasia. It is possible that our helplessness in this great problem is the outcome of too much attention to anatomic defects and too little to a possibly perverted physiology. There is reason to believe that sterility here is due to a physiological endometrial defect—the absence of some factor, whether hormone or enzyme, essential to the implantation of the ovum. While organotherapy offers nothing as yet in the way of treatment here, the time may well come when an endocrine sterility will be treated successfully by organotherapy.

ORGANOTHERAPY

The strictly gynecological indications for organotherapy rest upon the known facts concerning ovarian function, which furnish a rational basis for

ovarian therapy. Especially important is the study of the phenomena following complete removal of ovarian tissue, such as cessation of menstruation, the frequent appearance of troublesome subjective symptoms like those of the natural menopause, and certain metabolic changes. The inference from such observations is that the clinical symptoms apparently due to ovarian deficiency ought to be curable or at least relievably by the ingestion of the ovarian substance; this fundamental notion has been refined by stressing one or another ovarian constituent as the repository of the active principle, and so there are several forms of ovarian therapy in vogue, whether in the administration of the whole ovary or of the corpus luteum extract or of the so-called ovarian residue.

The earliest attempts in this field were in Landau's clinic in Berlin, 1896, where the fresh ovarian substance from the cow or sow was used. Fränkel, foster father of the corpus luteum theory of menstruation, used corpus luteum extract in a small series of cases; Burnam's paper in 1904 did much to popularize this therapy. A third preparation suggested by Graves in 1919 is the portion of the ovary left after removing the corpus luteum. The study of the pharmacodynamics of the various forms of ovarian extract has, until recent years, yielded unimpressive results, the most important facts gleaned being that the watery extracts, widely used hypodermically, are comparatively inert and that the active principle is somehow in the lipoid content of the ovary. The practical bearing of this is the obvious error in the degreasing common in preparing the commercial extracts. The recent work of Frank and of Allen and Doisy seems to show that the follicular fluid contains a principle which on injection into animals causes estrus changes like those observed by Hermann with the corpus luteum lipoids. There is no reason for assuming that this specific principle is found only in the follicles, as later work of the same authors has shown.

Commercial preparations available are whole ovary extracts, corpus luteum extracts, and the ovarian residue, in tablets, capsules, powder, or watery solutions (ampules). Of the forms other than watery solutions it is difficult to outline indications for preference. Whole ovary is perhaps more rational in developmental disorders ovarian in origin, while corpus luteum extract may be more desirable in disturbances revolving about the menstrual function. The theory for the employment of ovarian residue is not convincing, and it is by no means so generally used as the other two. In giving ovarian extracts orally, they may be made inert by the digestion. The follicle fluid is just becoming available, and it is too early to speak of results.

Functional Amenorrhea, Especially in Association with Adiposogenital Dystrophy.—Indications here are theoretically good, but the results are not striking, even when ovarian therapy is combined as usual with thyroid or pituitary extracts. Ovarian therapy is, however, more rational and safer than "emmenagogues," such as manganese and vegetable oils; it should not be used

until the physician is satisfied that the amenorrhea is not indicative of an incipient tuberculosis, anemia, or other systemic disease.

Uterine Hemorrhage.—A few report good results from ovarian therapy in some hemorrhages (especially the so-called menopausal functional form), but this method is still of doubtful value and falls into the same class as thyroid and posterior pituitary extracts. It should only be given after excluding organic pelvic disease, especially cancer.

Dysmenorrhea and Genital Hypoplasia (Infantilism, etc.).—The only dysmenorrhea in which, even theoretically, organotherapy seems indicated is the primary form, commonly associated with some degree of underdevelopment of the uterus, almost surely due to an endocrine defect the exact nature of which is unknown. As an ovarian secretion deficiency is believed by many to be a factor, whether primary or secondary, in this syndrome, ovarian products are often given, but results are not impressive.

Menopausal Vasomotor Symptoms.—Some virtue is here almost unanimously ascribed to ovarian therapy. Corpus luteum extract, more used than that of the whole ovary, appears to relieve the hot flushes, heat flashes, vertigo, and menopausal headache. Too often, on the other hand, the method fails utterly. While there is risk in inferences from such subjective symptoms, the therapeutic evidence is less disputable than in the other indications for ovarian therapy.

Sterility.—What has been said of dysmenorrhea applies to a sterility associated with a uterine developmental defect; organotherapy is rational. A few report good results (Fallenberg, Solomons), which far oftener are disappointing. The essential importance of excluding the commoner causes of sterility—inflammatory or other obstructions in one part or another of the genital tract, the male factor, etc.—must never be overlooked.

Obesity of Hypogenital Origin.—This is seen oftenest at the menopause, whether natural or surgical. Here, obviously, the use of ovarian extract rests on solid ground, but results are not striking, apart from the association with thyroid extract which is then clearly the potent agent.

Other Alleged Indications.—One need but name a few indications for ovarian therapy urged by enthusiasts, usually without reason and equally without result: Repeated abortions, uterine fibroids, exophthalmic goiter, deficient mammary secretion, epilepsy, pruritus vulvæ, etc. One may safely aver that no patient with any of these disorders will suffer from the omission of ovarian organotherapy.

Conclusion.—It must be emphasized that, rational as ovarian therapy appears in some ailments, the results, rarely striking, are often nil. It scarcely seems reasonable to expect that a commercial extract will replace the normal ovarian secretion developed and naturally administered in the living body, and there is, indeed, often doubt that such a product originally contains any active ovarian hormone.

Herein lies the crux of a problem, the solution of which depends largely on the biochemist. The physician testing ovarian therapy must keep his feet on the ground and not be transported by the exaggerated claims of those who have something to market nor yet by ill-advised premature reports of honest but deluded colleagues. A wise man once said, "Ought we to assume, if the administration of cascara relieves constipation, that the constipated individual had been a victim of hypocascarism?" There is little doubt as to the future import of ovarian therapy, but there is large room for discussion of its present value.

CHAPTER X

STERILITY

LAWRENCE R. WHARTON

ETIOLOGY

TREATMENT

Vagina and External Genitalia

Effluvium seminis

Cervix

STENOSIS

LACERATIONS AND INFECTIONS

Body of Uterus

RETRODISPLACEMENT

ACUTE ANTEFLEXION

MYOMA

Endometrium

Fallopian Tubes

Ovaries

CONGENITAL ANOMALY

ACQUIRED ANOMALY

Diet

Miscarriage

Sterility is the inability to beget viable offspring and is a condition which may affect husband or wife or both. A woman is presumptively sterile who is unable to conceive in the first three years of married life. It is primary when conception has never occurred and secondary when subsequent to a former pregnancy, instances of one-child sterility being included in the latter group. Closely related, also, are repeated abortions when the womb fails to carry the pregnancy to term.

Etiology.—It is variously estimated that from 20 to 50 per cent of the fruitless marriages are due to the sterility of the husband. G. L. Hunner and L. R. Wharton found azoöspERMIA or necrospERMIA in 20 per cent of a series of 526 sterile matings; other observers, notably German, report these conditions as high as 50 per cent. A few congenital aspermias of unknown origin are recorded. Obviously the virility of the husband should be established before the wife is treated.

The general health of the patient, her mode of living, and mental attitude may militate against conception. Dissipation of vital energy and lack of proper rest and relaxation are as unfavorable to health and childbearing as placidity

of temperament and freedom from nervous strain are conducive. Such persons functionally sterile are often capable of conceiving under a corrected mode of living. Constitutional or endocrine disturbances, chronic disease, or former infections must be considered; for example, mumps, scarlatina, acute rheumatic fever, or a severe labor may be followed by sterility.

The history should record the ages of patient and husband, number of years married, whether a former marriage was fruitful, duration of sterility and whether primary or secondary. If secondary, note details of former pregnancies, their termination, complications, and sequelæ. Data on menstrual and ovarian functions, indications of pelvic disease, and sexual relations should be full. Ovarian dysfunction may appear in an amenorrhea, profuse, prolonged, or irregular menses, absence of secondary sex characteristics, and progressive obesity, a characteristic syndrome usually associated with sterility. Dysmenorrhea is common and may result from a cervical stenosis, acute antelexion or retrodisplacement of the uterus, or tumor or pelvic infection. Menorrhagia or metrorrhagia suggests various pelvic disorders likely to prevent conception.

A history of pelvic infection is important. An unexplained illness with lower abdominal pain, perhaps labeled "appendicitis" or "inflammation of the intestines" should arouse suspicion, particularly if accompanied by urinary or menstrual disturbances and leukorrhea. A puerperal infection often causes a one-child sterility.

Sexual habits, such as lack of desire, dyspareunia, frigidity, actual dread of intercourse, or effluvium seminis may point to the underlying cause.

Often a woman has no complaint other than the sterility; therefore, not only the anatomical but the functional status of every organ in the reproductive system must be ascertained.

Lesions of the external genitals associated with sterility are congenital anomalies, absence or atresia of the vagina, septate vagina, imperforate, pain-

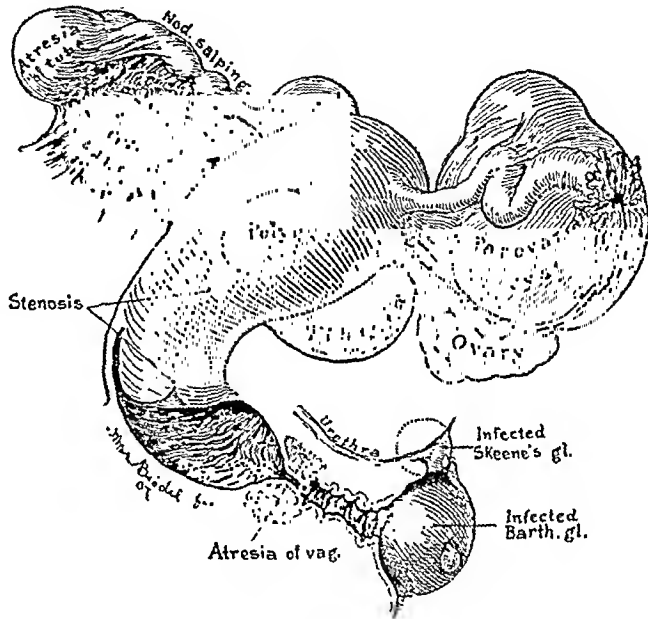


FIG. 123.—SOME CAUSES OF STERILITY.

Infection of Skene's or of Bartholin's gland significant of gonorrhea; atresia of vagina; stenosis of cervix; polyp hanging into uterine cavity; fibroid tumor; fibroid at attachment of uterine tube; parovarian cyst splinting tube and separating it from ovary; nodular salpingitis due to gonorrheal or tuberculous inflammation; atresia of tube, of inflammatory origin; ovarian and tubal adhesions.

ful, or rigid hymen, inflammation of Bartholin's glands, and infections and tumors of the vagina. Some of these conditions prohibit conception by interfering with intercourse; others, such as infections of Bartholin's glands and minor congenital anomalies, are significant by association with important lesions of uterus, tubes, and ovaries.

The cervix is inspected for infections, lacerations, hypertrophy, stenosis, polypi, and new growths, and lack of mobility of the cervix determined as evidence of inflammation or neoplasm.

Urethral, vaginal, or cervical discharges are examined microscopically, especially for gonococci, and the reaction of the latter secretions tested with litmus-paper. A normal vaginal secretion is sharply acid, milky, granular, and made up of desquamated epithelial cells, bacteria, and debris, and the cervical secretion is clear, mucoid, and alkaline; when the latter is acid or purulent, it is pathological and inimical to the spermatozoa. Profuse cervical leukorrhea often mechanically obstructs the cervix, preventing the passage of the sperm-cell into the cavity.

The uterus and adnexæ must be examined bimanually. Tumors, malpositions, inflammation, fixation, and developmental defects are the commonest palpable causes of sterility so far as the uterus is concerned. Impalpable endometrial lesions, such as polyps, hyperplasia, hypertrophy, and endometritis, are usually accompanied by menstrual irregularities and discoverable by curettage. Above the lateral vaginal fornices lie the pathological changes most frequently associated with sterility—salpingitis, tubal occlusion, and lesions of the ovaries. If obesity or nervousness make a satisfactory examination impossible, an anesthetic should be given.

In fully 10 per cent these procedures do not disclose the cause of sterility which is here dubbed relative. Within four years, this group has dwindled by tubal insufflation which reveals impalpable and unsuspected tubal occlusions.

The factors responsible for sterility are grouped as follows:

	<i>Per Cent</i>
Tubal occlusion	35-40
Cervical infections, lacerations, polyps, etc., producing leukorrhea	25
Retrodisplacement of uterus.....	14
Developmental anomalies of vagina, uterus, tubes, or ovaries (including infantile pelvic organs).....	11
Cervical stenosis with or without acute ante flexion.....	10
Lesions producing dyspareunia.....	5
Uterine myoma	5

Conditions occasionally met are cysts and tumors of the ovaries, tuberculous salpingitis, and cancer of the uterus. General factors, such as dietary insufficiency, anemia, physical or nervous exhaustion, and constitutional disease must be considered. In fully 5 per cent no cause is discoverable. The tubal and cervical infections responsible for more than half of the sterility are in general gonorrheal; such sterility is usually preventable, being often due to lechery.

The cure of sterility is doubtless one of the most appreciated of our services. Its successful treatment demands special skill, judgment, and patience, and the happy result depends upon the coöperation of the several parties involved, best realized when husband and wife place entire confidence in their physician. The treatment must necessarily often be experimental and the effect of a given therapy indeterminate for some months, an interval of expectation hard to endure unless the patient clearly understands the rationale of the method.

It is, therefore, important that the physician should thoroughly understand his case and be informed of the likelihood of conception, holding in check unreasonable hopes. When sterility is the only complaint, the decision to adopt any particular course of treatment should be left to the patient, particularly when there is risk.

Treatment.—*Vagina and External Genitalia.*—Lesions of the vagina and external genitalia produce sterility by making coitus extremely painful or impossible; a frequent cause of dyspareunia is an imperforate, rigid, or sensitive hymen. Childbirth often proves an effective cure by overcoming obstructive and spasmodic lesions.

Minor congenital anomalies of the vagina, such as persistent septa, are not incompatible with conception and are treated by excision. Patients with a double uterus may bear normal children if, in spite of nonunion, one or both müllerian ducts are functionally mature.

Effluvium seminis.—Many ascribe a failure to conceive to the escape of the semen immediately after intercourse, due possibly to a relaxed introitus. The fault can be corrected in a measure by posture, placing a large pillow under the buttocks before coitus and remaining in that position for an hour thereafter.

Cervix.—*Stenosis.*—Occasionally, the assumption that a contracted cervix is at fault secures brilliant results. About one-third of our cases so diagnosed and treated only by dilatation of the cervix have conceived. The average period of sterility was two years and the average interval between treatment and conception four months. This was the procedure so often used with gratifying success by Marion Sims and his contemporaries.

In dilating a stenosis, curettage is probably harmful; it is thought likely that the curet has actually caused sterility. Stem-pessaries have been used

when there was an attendant severe dysmenorrhea; the essential factor, however, remains the dilatation of the cervix. The best dilators are a small Hegar or the Goodell-Ellinger; whether this is done in office or hospital, a strict surgical technique is imperative.

Lacerations and Infections.—The significance of lacerations and infections of the cervix in sterility is rather hard to estimate, as the lesions are so common in fertile women. Personal experience shows that from 40 to 50 per cent of all sterile women have a pathological cervical discharge.

The method of treating these conditions is described in the chapter on leukorrhea. When the infection is deep, we rely on cauterizations as described by G. L. Hunner. Amputation of the cervix ought not to be done in women likely to become pregnant. Of seventy who had been sterile for at least two years and who were treated only by local applications or radial cauterization, eighteen conceived and were delivered without obstetrical complications.

Cervical polyps usually resulting from infection and overgrowth of granulation tissue must be removed and the bases cauterized; also, every such polyp should be examined for malignancy!

Lacerations may be important in miscarriage, when a wide tear shortens the canal and makes it patulous. An accurate plastic operation reconstructing the canal, with the least loss of tissue, is a help.

Body of Uterus.—**Retrodisplacement** is found in about 15 per cent, falling into two groups according as complicating pelvic lesions are present or absent.

The commonest and worst complication is tubal inflammation detected by uterine immobility and tender adnexal masses, usually preventing conception. A retroflexion in some proves a serious hindrance; the outlook is better if the displacement is uncomplicated when conception often follows correction. It has recently appeared that in retroflexion the fallopian tubes which are occluded may become patent when the displacement is corrected. Our gynecological forefathers were wont to boast of their control of fecundity in retrodisplacements by the Smith or Thomas-Smith pessary, which is still worth trying.

In obstinate cases, the knee-chest posture a few minutes daily for a period of ten days is recommended to effect a reduction. If such measures fail, the effective correction must depend upon an abdominal operation. Our own results have been equally favorable whether by manual replacement or by abdominal suspension. If sterility is the only complaint, one would hesitate to recommend an abdominal operation, and decision should rest entirely with the patient.

Acute ante flexion is usually congenital, and the prospect of conception depends not so much on overcoming the flexion or an associated stenosis as upon the development of the uterus. When menstruation is regular and approximately normal and the uterus is fairly well-developed, the attendant

dysmenorrhea and sterility can sometimes be corrected by dilatation and the insertion of a stem-pessary, which can be worn safely for a month or two.

Myoma.—Complaints of sterility are common in the relatively young, averaging well below thirty years; where due to myoma, however, the average age is about thirty-four. The period of sterility is correspondingly longer, as much as nine years on our list.

It is commonly observed that myoma and sterility go hand in hand. As a rule, intraperitoneal, pedunculate, and subserous tumors interfere less with conception; it is not only the site of the tumor but accompanying vascular and endometrial changes as well which are the determining factors. The endometrium in a myomatous uterus varies from hypertrophic to thin and atrophic. Submucous myomata with menorrhagia were present in 10 per cent of our myoma group. The sterilizing influence of a fibroid tumor is felt long before it is recognizable clinically.

In the Johns Hopkins Clinic, prior to 1913, after abdominal myomectomy, thirteen out of ninety-four conceived and but one miscarried; in thirteen vaginal myomectomies, but two subsequently became pregnant. Hunner and Wharton recently reported that of twenty-seven sterilities associated with myoma, fifteen either received no treatment at all or only dilatation and curettage, one of which conceived; of twelve submitting to abdominal myomectomy, five bore normal children. Recently we removed three myomata varying from 4 to 8 centimeters in diameter and a chocolate cyst about 10 centimeters in diameter from a patient who had suffered for two years from pelvic pain and menorrhagia; four years later she bore spontaneously a normal child and the pelvic organs were normal.

Myomectomy, therefore, distinctly increases the probability of conception, lessens miscarriage, and removes a cause of dystocia. Whether the patient conceives or not, improvement in general health and correction of menstrual irregularities justify the operation in the parous period.

Endometrium.—Conception is hindered and miscarriage caused by endometrial lesions which may be merely the local manifestations of a disease affecting the entire reproductive system, such as tuberculosis or gonorrhea, or the result of circulatory disturbances as in myoma and possibly in retroflexion. It is likely that ovarian disorders control endometrial abnormalities more than any other factor, as the hormones elaborated in the ovary govern menstruation and its associated local phenomena. When, therefore, the endometrial changes are purely secondary, the underlying factor must be discovered and corrected. Certain lesions, entirely local and restricted, such as polyps, some cases of endometritis, and hypertrophy, are amenable to local treatment by curettage; this is indicated, therefore, in the event of unexplained menstrual irregularities.

Fallopian tubes convey the ovum into the uterine cavity and probably also serve as a meeting place for ovum and spermatozoön. Tubal occlusion is the

commonest cause of sterility. In the interstitial portion, the lumen is so narrow and throughout its length numerous branching tufts of epithelium make the duct so tortuous that comparatively slight changes may cause adhesions and mechanical obstructions interfering with the transit of the ovum. Partial tubal obstruction is a cause of extra-uterine pregnancy, and complete and permanent occlusion prohibits conception.

Tubal obstruction may be due to a variety of conditions—inflammation, pressure, circulatory disturbances, congenital atresia—but often the cause is

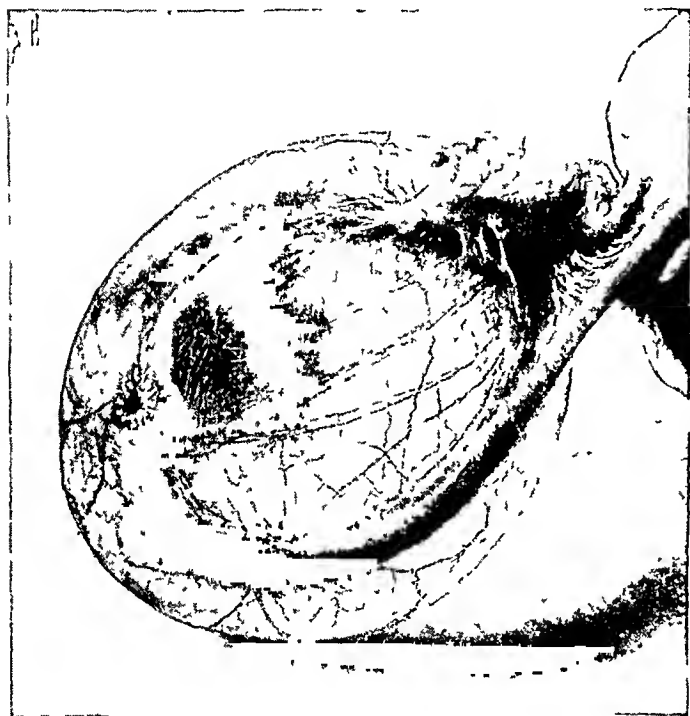


FIG. 124.—PAROVARIAN CYST.

A possible cause not only of sterility but of extra-uterine pregnancy.

uterus recently studied where the left tube was solid excepting a few disconnected islands of cylindrical epithelium, and on the right side there was no fimbriated extremity.

In a considerable group with complete or partial obstruction no cause is apparent. It may be congenital or the outcome of a low-grade nonspecific inflammatory process.

It is unwise to make a positive diagnosis based on one examination, as the occlusion may be due to some unexplained transitory condition.

Although it has long been known that closure of the fallopian tubes is the commonest cause of sterility, only recently has it become possible to estimate its actual importance. Formerly we estimated this as the cause in about 16 per cent of the sterilities, where there was palpable or visible evidence of tubal inflammation.

obscure. More tubes are closed by gonorrhea than by all other factors combined, whether puerperal infections, tuberculosis, peritonitis, or intra-uterine infections. They may also be closed by myomata and parovarian cysts. Since the introduction of tubal insufflation, it has been discovered that uncomplicated retrodisplacement of the uterus also produces tubal occlusion. Similarly, during or near the menstrual periods, tubes at other times normally open are occasionally impermeable. In these two groups, the occlusion is probably hyperemic. It may also be congenital, as in a double

In 1920, Isidor C. Rubin devised a method of determining the patency of the tubes by gas pressure, which has revealed the fact that tubal obstruction plays a larger rôle than heretofore imagined and that in about one-third of all sterilities both tubes are impermeable to gas and in 20 per cent there is an incomplete obstruction, leaving only about half with both tubes normal and patent. Although there is much yet to be elucidated, this procedure has revolutionized the study of sterility. It has demonstrated that tubes both appearing and feeling normal may be completely occluded, and it has compelled a reclassification of patients examined by former methods (Chapter XI). A further development of this test is pneumophotography, as through the cervix one can easily pass enough gas into the abdomen and outline a mass in any part of the peritoneal cavity, occasionally offering a simple means of differentiating intra- from extra-peritoneal tumors.

Ovaries.—We know but little concerning the ovary and its functions, while its rôle in conception is clearly fundamental. Our knowledge of ovarian sterility is chiefly based on indirect clinical evidence and methods of treatment empirical.

Ovarian sterility is congenital or acquired. The congenital type is due to a retarded development and persistent infantile characters, with irregularities or absence of menstruation and frequently pronounced endocrinopathies. In the acquired type, the ovarian function, once normal, is interfered with by inflammation, new growths, or other factors.

Congenital Anomaly.—Temporary disturbances of the endocrine balance are not uncommon during adolescence, as in the goiter of puberty and menstrual irregularities. When developmental abnormalities persist and affect the ovaries, inhibitions varying in severity from outspoken sexual infantilism to minor grades of genital hypoplasia result. The uterus is subnormally developed; the cervix is elongated, conical, and even larger than the uterine body; the size of the ovaries varies with the presence of retention cysts and is, therefore, not always an accurate criterion of their developmental state, at times being long and slender and yet functionally active. Menstrual irregularities, amenorrhea, and occasionally long and scanty menstrual periods are the rule. Sterility is almost invariable.

Successful treatment presupposes knowledge which we do not possess. Unfortunately, the brilliant results achieved by thyroid extract in cretinism or insulin in diabetes find no parallel here. Occasionally pregnancy has followed the use of glandular extracts; also, after years of marriage and sexual stimulation, conception has occurred without medical therapy. C. F. Burnam has recently tried x-ray stimulation with a remarkably successful case. The prognosis is discouraging but not absolutely hopeless. One patient in this group who failed to menstruate for six years, later bore a normal child.

Acquired Anomaly.—The commonest cause of an acquired ovarian sterility is a pelvic peritonitis—an ascending gonorrheal infection embedding the ovary in adhesions and thickening its capsule and interfering with the

extrusion of the ovum. Ovarian abscess due to tuberculosis or gonorrhea may result in the complete destruction of the sexual glands with amenorrhea and absolute sterility.

Among the tumors, corpus luteum and chocolate cysts, often causing sterility, are frequently confused with myomata and pelvic inflammatory diseases. These endometrial cysts become firmly adherent in the pelvis and are associated with menstrual irregularities and sterility. Ovarian and parovarian tumors cause sterility by splinting or compressing the tube and making the fimbriated end functionless.

The ovaries are remarkably persistent in their functions, as menstruation goes on and conception sometimes occurs in spite of "insurmountable" obstacles.

The treatment of these crippled organs is usually surgical, consisting in severing adhesions to free the ovary and extirpating cysts and benign tumors. The decapsulation of a thick tunica yields but indifferent results.

Diet.—The effect of diet on productivity has been studied extensively by E. V. McCollum who has demonstrated that in rats the physiology of the sexual organs is an accurate index of their nutritional balance and that a diet sufficient for normal growth may yet be so deficient as to inhibit estrus and reproduction. H. M. Evans and Katherine Bishop find that a generally deficient although well-balanced diet not only stunts growth but also prevents ovulation and that sexual inhibition varies directly with the degree of starvation. The withdrawal of carbohydrates is apparently not deleterious; fat deprivation, however, regularly retards sexual development, even though under certain dietary conditions body growth is practically normal. The effect of salt deprivation is definite but less marked, particularly when the rest of the diet is adequate and well-balanced. Well-nourished adult animals may not be affected by partial withdrawal of vitamin A, but such a diet immediately after weaning definitely hinders ovulation. Sex functions are particularly sensitive to the lack of vitamin B; upon its withdrawal ovulation ceases before general nutrition is noticeably affected. Animals raised on a one-article diet such as wheat or milk, often fail in sexual development.

In 1921, Reynolds and Macomber reported that by restricting certain elements in the diet and by inbreeding they could alter the fertility of rats and produce animals exhibiting various and predictable degrees of sterility. Some of these rats, although unable to reproduce when mated among themselves, reproduced at once if mated with normal animals of high virility, being, therefore, relatively but not absolutely sterile. Macomber concluded: "The fertility of a mating is the result of the product of the fertility of the two individuals concerned. If this mating fertility is above a certain level, the mating is productive; if not, it is unproductive. This level we have called the threshold of reproduction."

Usually it frequently occurs that men and women whose first mating

proved barren reproduced normally in a subsequent marriage. While this "threshold of reproduction" cannot be gauged in men, it is reasonably certain that the factors Macomber and Reynolds find so important to animal breeders also influence human reproduction.

Miscarriage.—Not infrequently a woman seems utterly unable to go to term and gestation terminates in a miscarriage or a premature stillbirth. At times, the offending cause is discoverable but often it defies detection.

In general, such catastrophes are due either to embryonic abnormalities or to the mother. F. P. Mall was the first to discover the significance of fetal malformation by finding the embryos were imperfect and monstrosities in a large percentage of all miscarriages and that abortion is therefore a merciful termination. In every miscarriage, the fetus should be submitted to an embryologist.

On the mother's side, the miscarriage may result from a general or a local disease. Of all systemic maladies, syphilis oftenest causes fetal death; the embryo may acquire the disease and develop its lesions and it may die *in utero* or it may be born with the stigmata. Williams has shown that syphilis is the commonest cause of stillbirth and premature labor during the last four or five months of pregnancy, and that appropriate treatment of the mother during pregnancy practically eliminates dead born children due to this cause. Among maternal diseases associated with miscarriage in the earlier months are: Chronic nephritis, diabetes, heart disease, anemia, and, less frequently, lung diseases. Williams attributes the outcome in this group to toxic substances or other changes in the blood. Hertwig and Stockard were able with great regularity to produce gross malformations or death of the embryos of frogs and fish (*Fundulus heteroclitus*) by increasing the salt content of the water in which they live. G. L. Hunner has found that women who repeatedly miscarry may harbor a chronic urinary infection and a hydronephrosis and that with adequate renal drainage they may go to term. Kretschner has shown the frequency with which the ureters and kidney pelvis become dilated during pregnancy, the urinary stasis thus acting as the predisposing cause for an infection. Max Sänger had this much in mind as far back as the late eighties.

Local conditions causing miscarriage include uterine malpositions, tumors, cervical lacerations, endometrial abnormalities, and trauma. A retrodisplacement of the uterus also ends in a miscarriage by becoming incarcerated and the congestion associated with retroflexion is also unfavorable; for this reason, it is wise to correct the malposition when discovered, if necessary using an anesthetic. Such a patient needs careful watching until the womb becomes an abdominal organ. Myomata often grow markedly in pregnancy and if located in the lower uterine segment may be unfavorable both to conception and to the continuation of gestation. A relatively small cervical fibroid sometimes leads to early dilatation of the cervix and abortion. Cervical lacerations are reckoned among the causes of miscarriage, due to a shortening of the canal

and deploying of the internal os. A similar lack of support with abortion follows high cervical amputation.

In a considerable group the cause is recondite and ineluctable. It is wise to take exceptional care of this group of patients from the very onset of pregnancy, especially avoiding overexertion and tire. Life should be more or less sedentary and in the exceptional case a moratorium for the entire gestation period is the wisest prescription.

CHAPTER XI

PERUTERINE TUBAL INSUFFLATION IN STERILITY

ISIDOR C. RUBIN

INDICATIONS FOR THE TEST

APPARATUS

TECHNIQUE

INTERPRETATION

Normal Tubes

Closed Tubes

Spasm of Tubes

REPETITION OF TEST

EFFECT UPON MENSTRUATION

THERAPEUTIC VALUE

SUMMARY

Peruterine tubal insufflation was devised for the specific purpose of determining the patency of the fallopian tubes. Before this method was available, one was obliged to resort to exploratory laparotomy in sterility, as normal tubes are not palpable *per vaginam* in the majority of instances and diseased tubes are so often implicated with diseased ovaries that they are indistinguishable by vaginal touch. Where the tubal factor was not ascertained, operative procedures to relieve sterility too often failed; thus, all the otherwise technically excellent operations upon the cervix, not associated with an abdominal section, were futile in the presence of closed fallopian tubes. Such experiences have been only too common, to the chagrin of both surgeon and patient.

Rubin's experiments to find a nonoperative method of determining tubal patency were first on animals and later employed clinically.

Solutions opaque to x-rays were injected into the uterus and through it into the tubes. Roentgenograms showed shadows of the uterine cavity and the tubal lumina. Collargol, thorium, bromid, and iodid solutions were each in turn injected into the uterus and tubes as far as the point of obstruction, and satisfactory pictures obtained. When the tubes were normally open, the pictures were not nearly so clear because of percolation into the peritoneal cavity. Cary appears to have been the first to try this method clinically. Results with the injection of solutions in Rubin's cases were not altogether favorable as, on entering the abdominal cavity, they produced an appreciable amount of irritation and peritoneal reaction, while collargol had the additional disadvantage of becoming inspissated within the tubes. When the latter were

closed, however, no such sequelæ followed intra-uterine injections. This is true of practically all fluids injected into the uterus, including lipiodol, so far the least irritating. A further disadvantage inherent in fluid media is the transportation of genital secretions into the pelvis where they gravitate and may excite inflammation with resultant adhesions. These drawbacks were obviated by using gas, at once found to be the long-sought desideratum in determining tubal patency.

Gas is preferable as less apt to carry uterine and tubal secretions into the peritoneum; it does not mix with the secretions and the moment it enters the peritoneal cavity it rises to the upper abdomen where it is rapidly absorbed, leaving no residuum. As this method developed it proved to be a diagnostic aid in determining nonpatency.

The method of peruterine tubal insufflation, or tubal perflation through the uterus¹ was begun in November, 1919, at Mount Sinai Hospital, New York. The first clinical application while crude was effective. Oxygen was allowed to pass into the peritoneum of a patient who was sterile. The abdomen was observed closely and seen to rise with a complaint of distention and epigastric pain. On standing, there was severe pain in the shoulders and diaphragmatic region, and the x-ray plates showed a general pneumoperitoneum. The quantity of gas introduced was about 2 liters.

This taught the need of reducing the amount of gas injected, of manometric control, and of a means of measuring exactly the volume of gas insufflated. Accordingly the siphon volumeter and a mercury or spring-type manometer were adopted. It was then found that a diminutive pneumoperitoneum (subphrenic pneumoperitoneum) was as demonstrable by fluoroscopy as the larger pneumoperitoneum by an x-ray plate—a definite improvement because applicable to ambulatory cases. Another change was the replacing of oxygen with carbon dioxid which, as Alvarez has shown, is rapidly absorbed. When 150 c.c. or less of gas is used, phrenic irritation and shoulder pains are but momentary. Combining these factors, peruterine tubal insufflation soon became an office procedure. The test requires but one or two minutes, and within five or ten minutes, the patient is ready to leave the office, able to go about her affairs.

Indications for the Test.—Peruterine tubal insufflation should be used:

1. In primary sterility where contributing causes, including those for which the husband might be responsible, have been eliminated and some operative procedure is contemplated. Here it has a definite prognostic as well as diagnostic value.

2. In primary sterility when the patient has had a gonorrheal pelvic infection soon after marriage but for the present is free from pelvic symptoms.

¹The method has been variously named by authors both in this country and abroad as follows: "Transuterine tubal insufflation," "perflation of the tubes," "uterotubal perflation or persufflation," "blowing through the tubes," etc.

3. In sterility following a pelvic exudate or abscess complicating a puerperium or abortion, with or without the history of an operation, where resolution has apparently taken place.

4. In primary sterility after a peritonitis of appendical origin, premarital or postmarital, to exclude tubal occlusion by peritoneal adhesions.

5. In one-child sterility, without any definite history of pelvic infection.

6. Following the conservative removal of one whole tube and part of another for hydrosalpinx or pyosalpinx.

7. After unilateral ectopic pregnancy to ascertain the status of the remaining tube.

8. After salpingostomy to determine the success of the operation.

9. After sterilization by tubal ligation, to test the patency of tied or severed tubes.

10. After multiple myomectomy in nulliparæ, to ascertain the permeability of the tubes.

11. In sterility of long standing where pelvic masses are palpable but not tender and clinically diagnosed as fibroids or "chronic adnexal disease," to determine whether or not the tubes are open.

12. As a therapeutic measure, eliminating the tubal factor in sterility.

The test must be conducted in accord with the rules deduced from repeated careful experiments and an already large experience. It must not be done in the presence of inflammatory masses or fever, nor during menstruation or any uterine bleeding, nor if the patient has any serious cardiac, renal, pulmonary, or metabolic disturbance, generally found in individuals who are poor subjects for pregnancy and labor.

With a proper application no untoward results have been noted in an extensive experience at home and abroad. Two fatalities occurring in New York City seem inexcusable, the operator having violated the salutary rules and improperly selected the cases. In one, death was due to shock from a terrific injection of the gas in a woman of forty-two, a quadripara with cardio-renal disease; in the other, it was due to embolism from an excessive insufflation of gas under great pressure following enrettage in a patient with multiple fibroids and a bilateral pyosalpinx, after the forcible dilatation of an amputated cervix.

A rare possible risk is in a chronic tubal suppuration with a patent fibrinated end. As the pus is here usually innocuous, the danger is slight. Absence of tenderness on bimanual examination and the absence of any subsequent reaction gives assurance that there will be no serious sequelæ. In doubtful cases the sedimentation test and observations on the behavior of the temperature for twenty-four hours following the vaginal examination help diagnose the presence of latent or subacute pelvic inflammation.

The most favorable time (*J. Am. M. Ass.*, 1925, 84), is from four to seven

days after the cessation of a regular menstrual flow when the endometrium is flat and the uterine tubal ostia are not obstructed by the swollen endometrium of the premenstrual phase—a period less likely to interfere with a possibly impregnated ovum. There is also less likelihood of bleeding. Insemination soon after a postmenstrual insufflation offers the best chance of the spermatozoa reaching the tubes to await the ovum. A greater incidence of pregnancy results from a close adhesion to this rule.

Apparatus.—The apparatus consists of a 100-gallon tank of carbon dioxide gas under 1,000 pounds pressure; a reducing gauge; a siphon meter of the

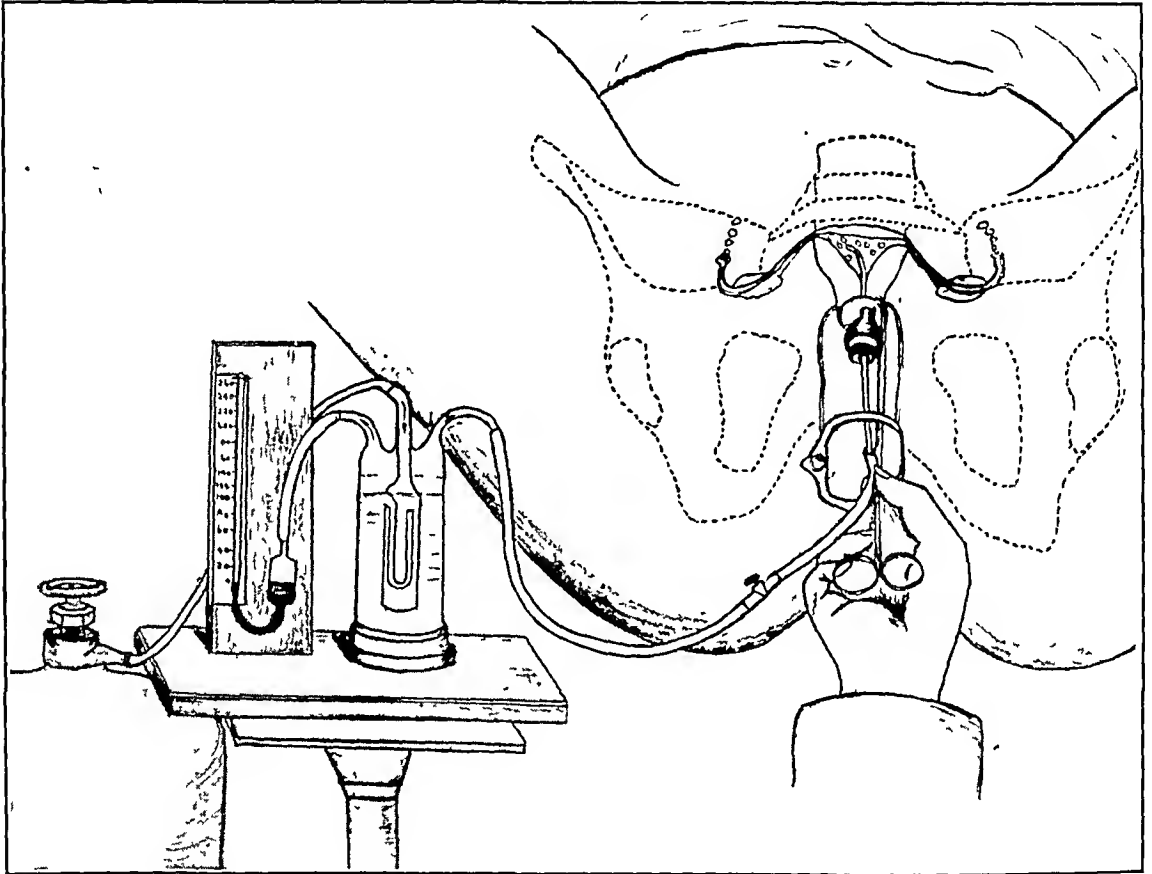


FIG. 125.—INSUFFLATION APPARATUS ASSEMBLED.

Cannula well within uterus held firmly with tenaculum grasping anterior cervix lip so that urethral rubber tip fits into external os and prevents escape of gas.

type used in chlorinating water; a manometer (mercury, spring type); a rubber tube connecting the tank through volumeter and manometer to a metal cannula (Keyes-Ultzmann type), fenestrated at its tip; a rubber "acorn" (urethral tip), fitted over the cannula to allow the tip to enter well into the uterine cavity while the acorn itself engages the external os and prevents premature regurgitation of the gas along the cervical canal; a needle valve between the volumeter and the cannula. In most nulliparæ, the "acorn" is not important, but in relative sterility with an external os dilated by cervical lacerations the "urethral" tip is important for complete air-tightness.

Technique.—The genital canal should be prepared as for a surgical procedure—all secretions wiped away and the cervix carefully cleansed. Any secretion in the cervical canal can be squeezed out between the blades of the bivalve speculum or with an ovum forceps. The interior of the canal should be wiped out gently with a sterile cotton swab without bleeding. A tenacious mucous plug can be removed by aspiration. A sterile swab saturated with tincture of iodine is next introduced into the cervix up to the internal os and the outside of the cervix painted. The anterior lip of the cervix is then caught with a tenaculum on its upper surface where it causes but slight pain.

The gas is now released from the tank and the displacement of the water in the siphon meter noted; this should not exceed three pulsations per minute. A time-ratio-flow of fifteen seconds to raise the mercury column to 100 millimeters is the most favorable rate of flow of the gas into the uterus. It may be slower, requiring twenty to thirty seconds to raise the mercury column to 100 millimeters, but it should never be less than fifteen. The uniform rate-flow of fifteen seconds serves as a standard of comparison when several insufflations are necessary for the same patient, as the data obtained are then more readily interpreted. The normally patent tubes are thus distinguished from those hopelessly closed and from those stenosed and amenable to treatment.

The cannula is then inserted into the uterine cavity to a point just below the fundus but well beyond the internal os, without bleeding. Where the internal os is tight, it may be necessary to overcome the stricture by one or more gentle dilatations to let the uterine cannula pass easily. The pressure at the cannula tip at the time of introduction is zero, accomplished by turning the needle valve until it is well open and shutting it tight again as soon as one is ready to allow the gas to pass through into the uterus. This moment is synchronous with the beginning of the pulsation in the volumeter, when the gas is seen to approach the bottom of the U tube in the siphon. That is easily controlled by the operator who counts the number of pulsations to calculate the total amount of gas he plans to introduce.

For the average patient two pulsations are enough to furnish a subphrenic pneumoperitoneum with its associated clinical signs (*Am. J. Roentgenol.*, 1921, 8). Each pulsation represents 30 to 40 c.c., the standardized capacity of the glass siphon. In obese patients from three to five pulsations may be necessary, but the quantity seldom exceeds 200 c.c.

The manometer is watched to determine the point at which the pressure falls, the initial drop indicating the point at which the gas is released through the fallopian tubes into the peritoneum which, in open tubes, is usually under 100 mm. Hg. With closed tubes, there is no initial drop and the pressure continues to rise to 200 when the valve at the tank must be closed while the behavior of the mercury manometer is noted for a few seconds. As the cannula and tenaculum are withdrawn from the uterus, it is well to pinch the rubber tubing near its attachment to the uterine cannula and to note any



FIG. 126.—RIGHT-SIDED SUBPHRENIC PNEUMOPERITONEUM.

About 150 c.c. of carbon dioxide gas introduced into peritoneal cavity via uterus and tubes.

escape of gas into the vagina from the uterus as showing whether or not the gas has actually entered the uterine cavity according as the cannula was or was not obstructed by secretions. Careful note must be made of the character and location of the pains produced by the injection of the gas through the uterus as a point of diagnostic value.

The patient is at once fluoroscoped upon rising from the examining table; with patent tubes a single- or double-sided subphrenic pneumoperitoneum can

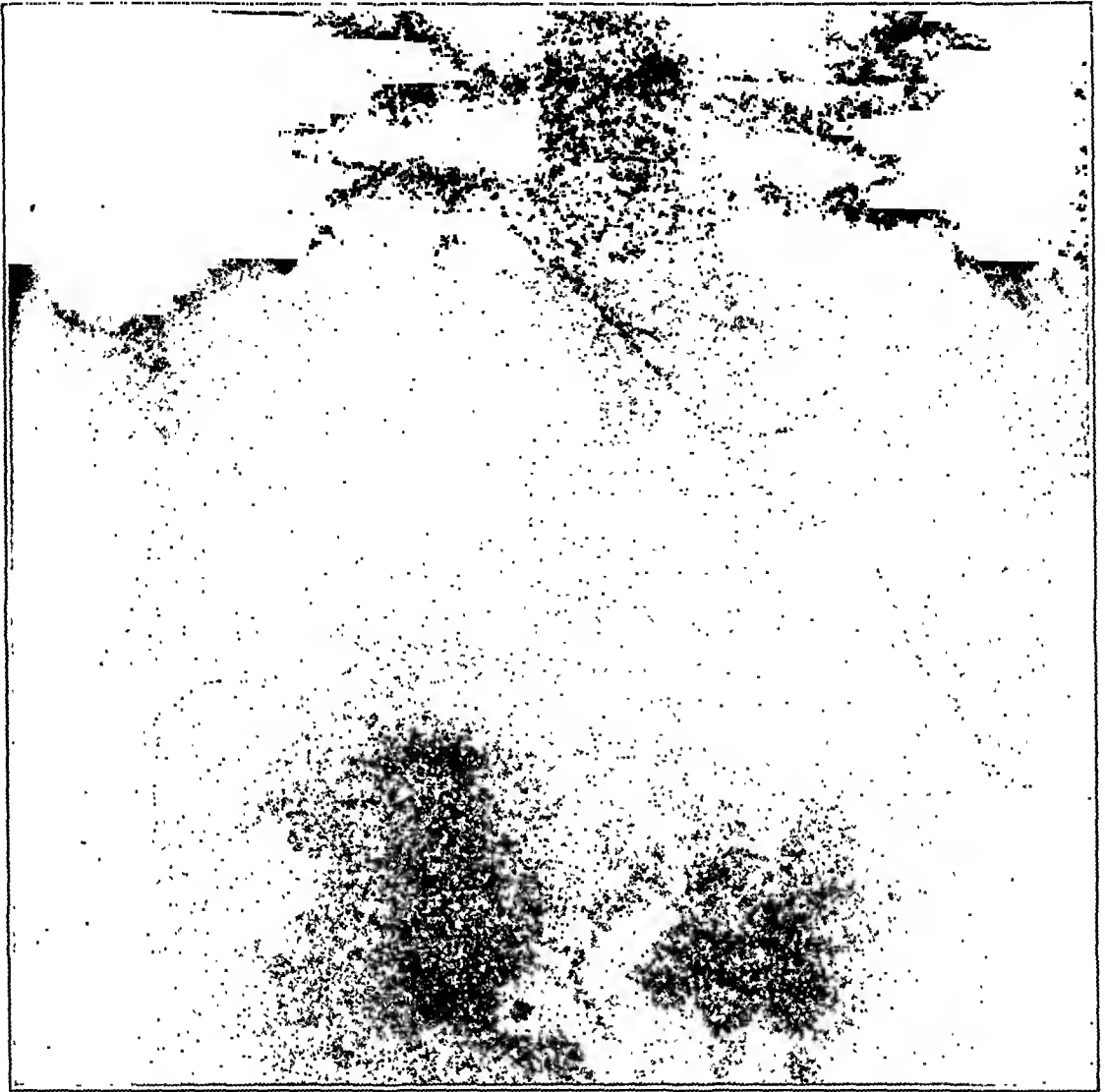


FIG. 127.—SMALLER RIGHT-SIDED SUBPHRENIC PNEUMOPERITONEUM.

75 c.c. of carbon dioxid gas introduced into peritoneal cavity via uterus and tubes.

be demonstrated with uniform regularity, Figures 126 and 127, with voluntary complaint of pain in one or both shoulders, depending on the amount of gas introduced and on her sensitiveness. The hypersensitive will notice the shoulder pains at once and the phlegmatic often not at all; sometimes the pains occur only after a few minutes. In general, less gas evokes this symptom in thin than in obese individuals. Troublesome pains disappear instantly in the knee-chest posture. Rarely, one is unable to tolerate the test; then anesthesia is advisable, the greatest caution being exercised in insufflating as the telltale symptom, pain, is abolished.

Uterine insufflation should never be preceded by forcible cervical dilatation or curettage or any operative procedure which opens the uterine blood-vessels, whether with or without anesthetic.

It is obvious that any method which does not meet all the requirements

of an investigation of tubal patency fails in securing sundry important data. The most necessary factor in a scientific and safe application of peruterine tubal insufflation is the uniform pressure rate-flow and volumetric control. All methods depending upon hand pressure, as when the syringe or a rubber bulb is used, fail to furnish the even flow of the gas tank with an accurate release valve. Simplified methods of uterine insufflation have encouraged careless tests and are doubtless sometimes responsible for disaster, a fact not adequately appreciated. In expert and careful hands, the use of the syringe and bulb for peruterine insufflation may serve as a rough test where appropriate means are not available; important diagnostic details are, however, missed, and in a certain number the result is failure.

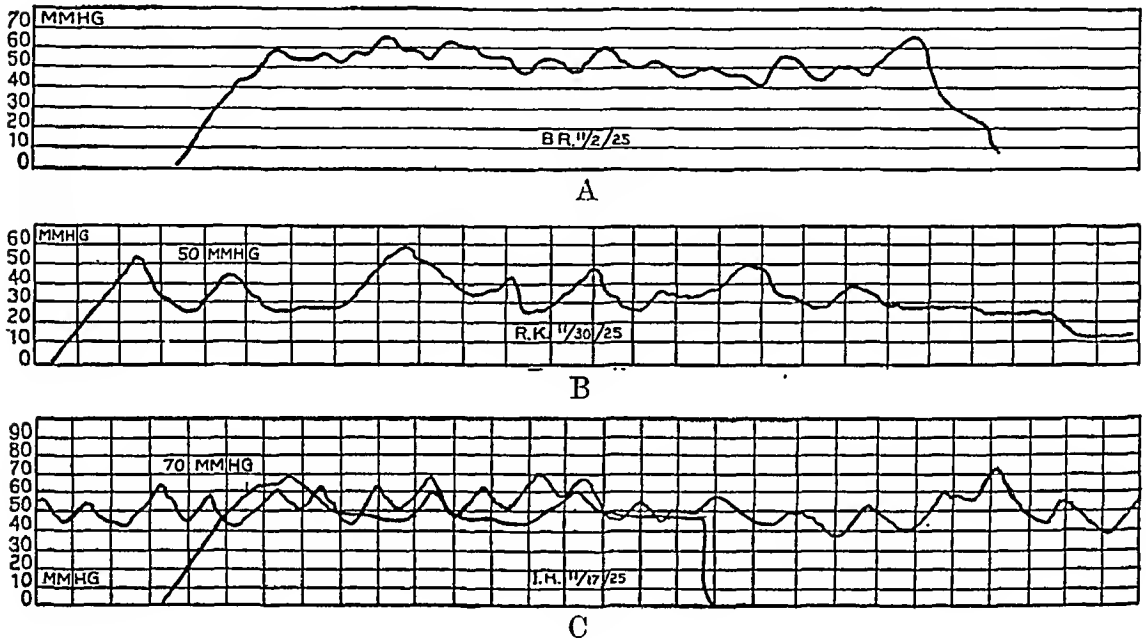


FIG. 128-A, B, C.—KYMOGRAPHIC RECORDS OF UTEROTUBAL INSUFFLATION IN PRESENCE OF NORMALLY PATENT TUBES.

Ordinates represent five-second intervals.

Interpretation.—*Normal Tubes.*—The mercury rises to 40, 60, 80, or even 100 millimeters and drops 10 to 40 points, fluctuating several times until the cannula is withdrawn, Figure 128. Usually the patient has slight pains referred to the uterus, sometimes similar to “unwell pains”; pain on the side is uncommon. The pressure fluctuations are probably due to tubal peristalsis. Kymographic studies made of late tend to show that the fallopian tubes contract rhythmically, as registered on the drum as the gas passes through into the abdomen.²

Recent studies with a kymograph of the behavior of the uterus and tubes during insufflation promise light on tubal physiology and tend to corroborate the findings of Snyder and Seckinger of the Carnegie Institution in Washing-

² These studies await publication.

ton, D. C., who studied the rhythmic contractions of freshly removed uteruses and tubes at the Johns Hopkins Hospital.

F. C. Lee (*Proc. Soc. Exper. Biol. & Med.*, 1925, 22) reports interesting observations from the injection of India ink into the cornu of the uteruses directed toward the fallopian tube; the cat used was not in the estral period, the uterus being small and the ovaries showing no follicles. He found that "the ink passed into the tubes under great difficulty, a pressure of 280 millimeters of mercury being often necessary in repeated experiments. On the

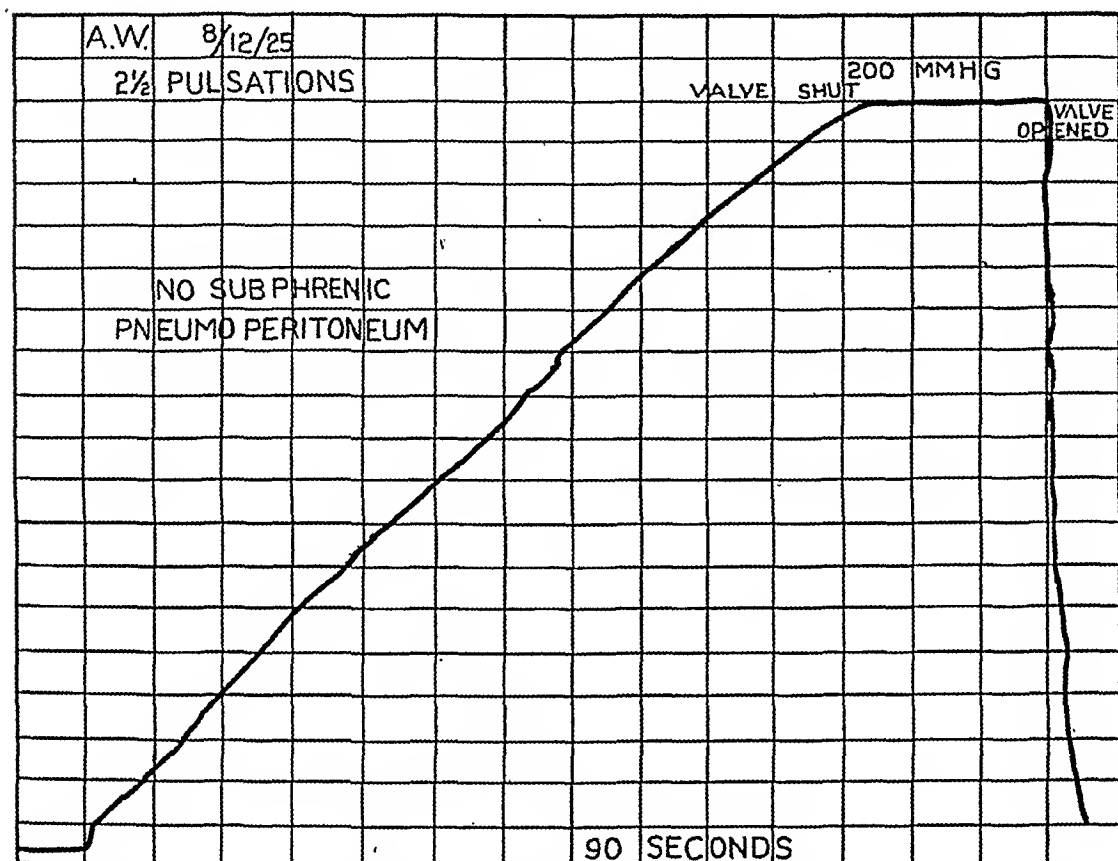


FIG. 129.—KYMOGRAPHIC RECORD OF UTEROTUBAL INSUFFLATION IN PRESENCE OF CLOSED FALLOPIAN TUBES.

other hand, in the same animal, injections into the tubal isthmus directed toward the cornu passed easily in the opposite direction into the uterus. However, when the uterus was large and swollen and when relatively large follicles appeared in the ovary, then the passage upward from the tube was easy. The recent report of Rubin on the various pressures necessary for transuterine insufflation of the tube at various stages in the intermenstrual period of the same individual is in harmony with the general principle obtained in the work on mammals. It is believed that the uterine end of the tube, in its varying degrees of patency, is to a great extent responsible for the different pressures obtained. The material examined so far indicates that the greater patency occurs about the period of ovulation and probably a little before that time.

Closed Tubes.—If one tube is closed or stenosed and the other normally open, pain on the obstructed side is experienced. With both tubes closed or stenosed, the pain is bilateral. This is due to distention of the tubes proximal to the obstruction and is noted whenever this is situated at any point beyond the isthmus.

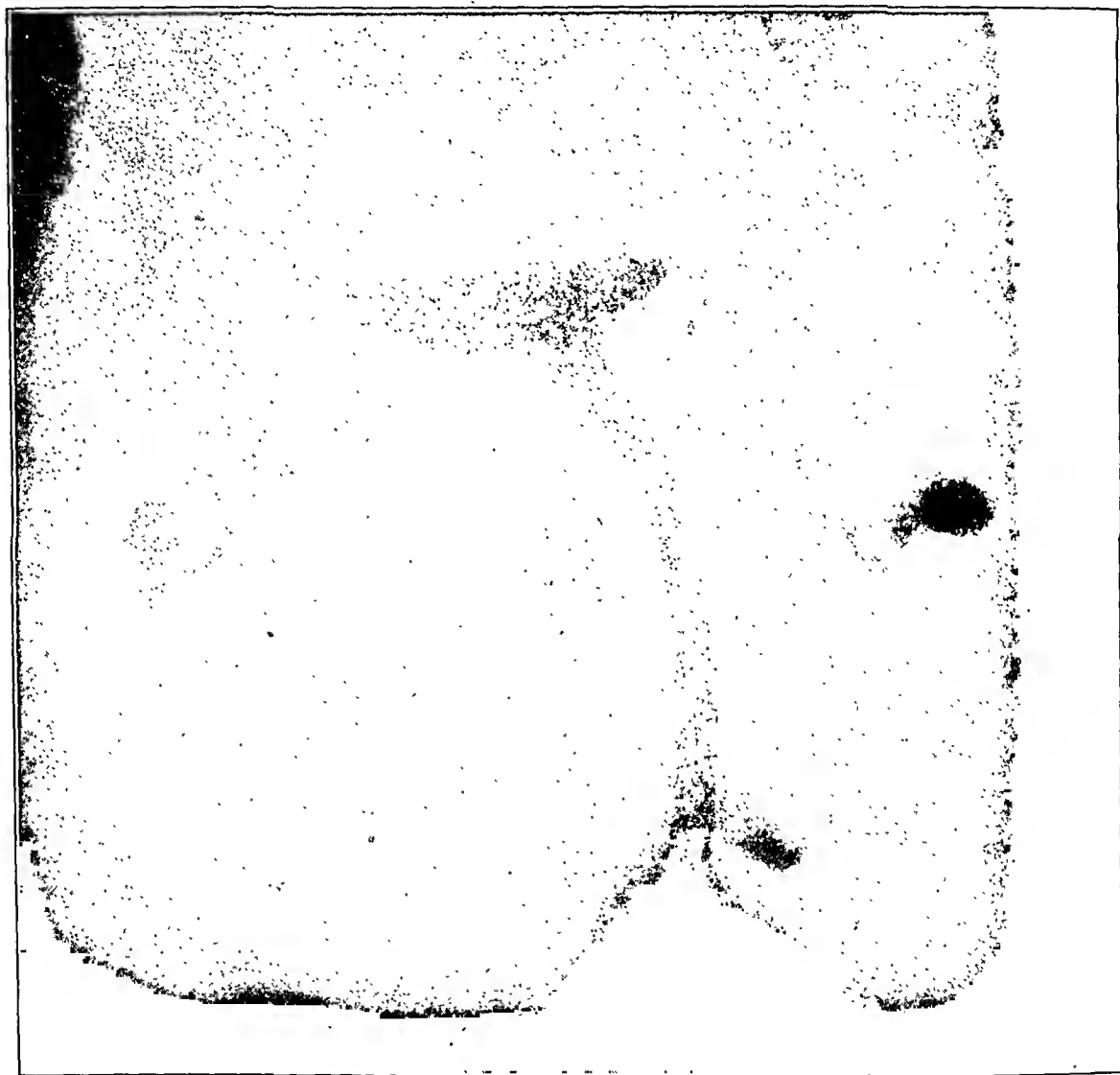


FIG. 130.—ROENTGENOGRAPH AFTER LIPIODOL INJECTION INTO UTERUS AND TUBES, SHOWING BILATERALLY CLOSED TUBES AT FIMBRIA (CLUBBED ENDS).

When the manometer rises to 200 mm. Hg, Figure 129, and there is uterine colic or midline pain referred to the suprasymphyseal area with no complaint of pain on either side, the closure is at the intramural portion of the tubes or near the isthmus of each side.

These observations are practically pathognomonic of the site of obstruction as they check up closely with lipiodol injections into the uterus, Figures 130, 131 and 132. It is not necessary, therefore, in the average case to inject

opaque solutions for this demonstration although it may be of value when an operation is planned to open closed tubes.

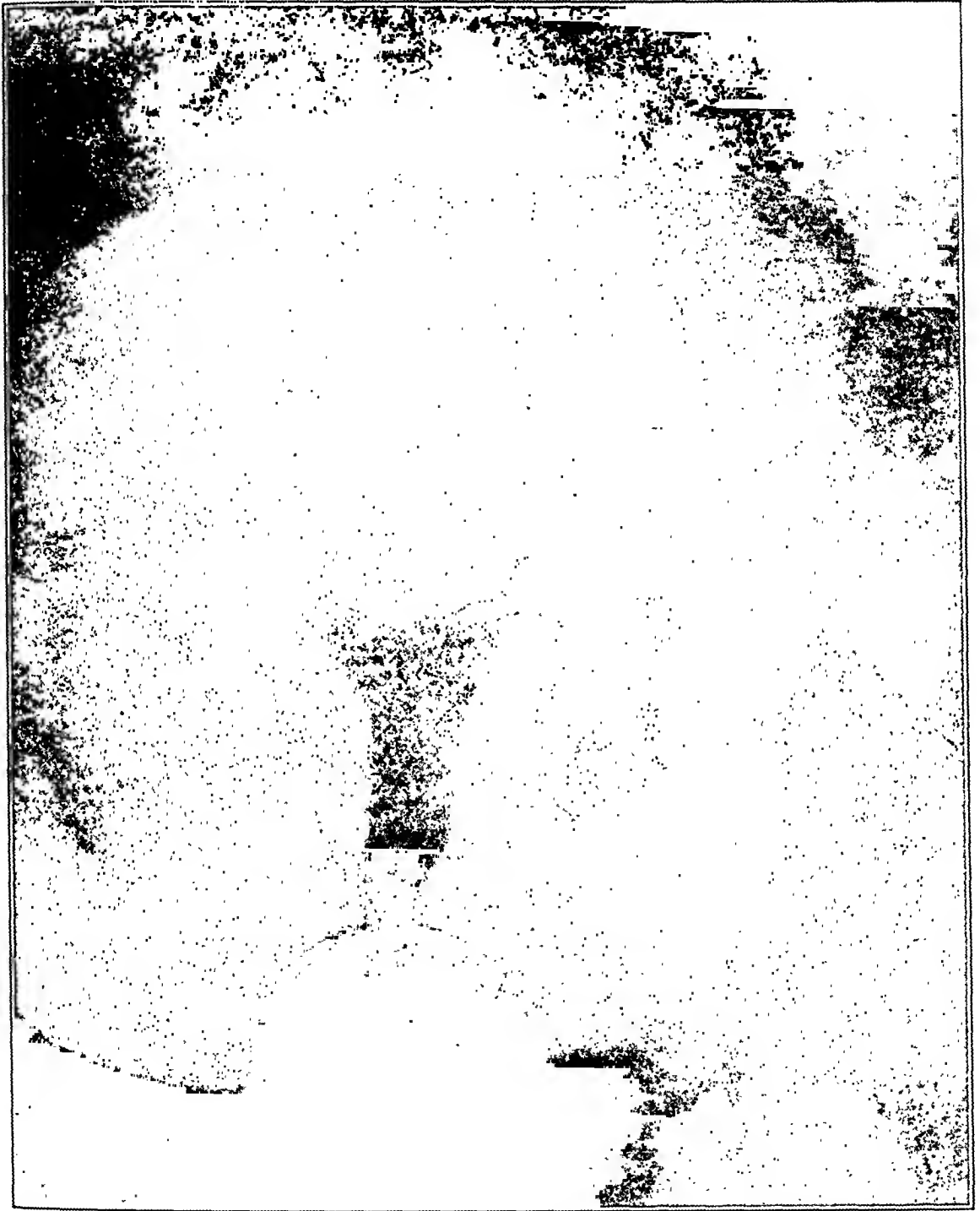


FIG. 131.—ROENTGENOGRAPH AFTER LIPIODOL INJECTION INTO UTERUS AND TUBES, SHOWING AN OCCLUDED RIGHT TUBE AT UTERINE TUBAL JUNCTION AND CLOSED DILATED LEFT TUBE.

Spasm of Tubes.—Sometimes a relatively high pressure is followed by a drop indicating a small amount of gas escaping through a minute opening, Figure 133. Observations point to the intramural and isthmial portions of

well as the fimbriated ends as the site of predilection for spasm. Studying this with sodium bromid and sodium iodid injections into the uterus, W. T. Ken-

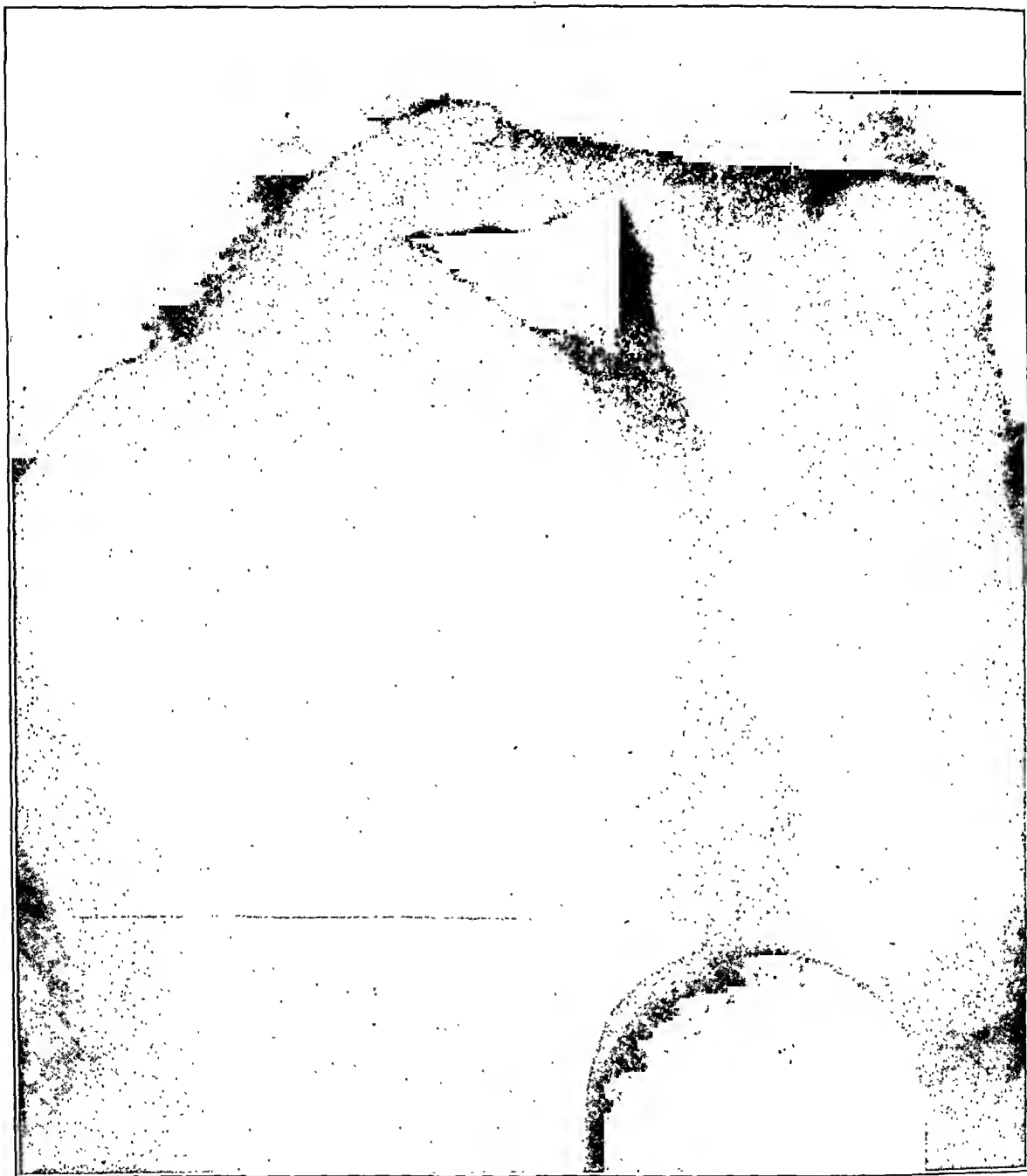


FIG. 132.—ROENTGENOGRAPH AFTER LIPIODOL INJECTION INTO UTERUS, SHOWING TOTAL ABSENCE OF LEFT TUBE AND A SMALL STUMP OF RIGHT TUBE.

Patient operated upon; operation findings not known to her.

nedy (*Tr. Am. M. Ass.*, 1925, 85), maintains that he has demonstrated isthmio-spasm. S. R. Meaker (*Boston M. & S. J.*, 1924, 191), demonstrated tubal

³Tl cesu¹⁴ ce adduced by Kennedy has received a somewhat different interpretation by the nt work with lipiodol injections into the uterus associated with fluoroscopic

spasm by x-ray pictures during an injection of carbon dioxid and again after half an hour in a hydrosalpinx. During the gas injection he showed a distention of the tube not visible half an hour later, proving that it was prevented from escaping immediately back into the uterus by a spasm of the isthmal portion.

The high pressure required to overcome an organic obstruction or stenosis, Figure 134, may be distinguished from that due to tubal spasm in the following manner: The cannula is held inside the uterus after the gas has been

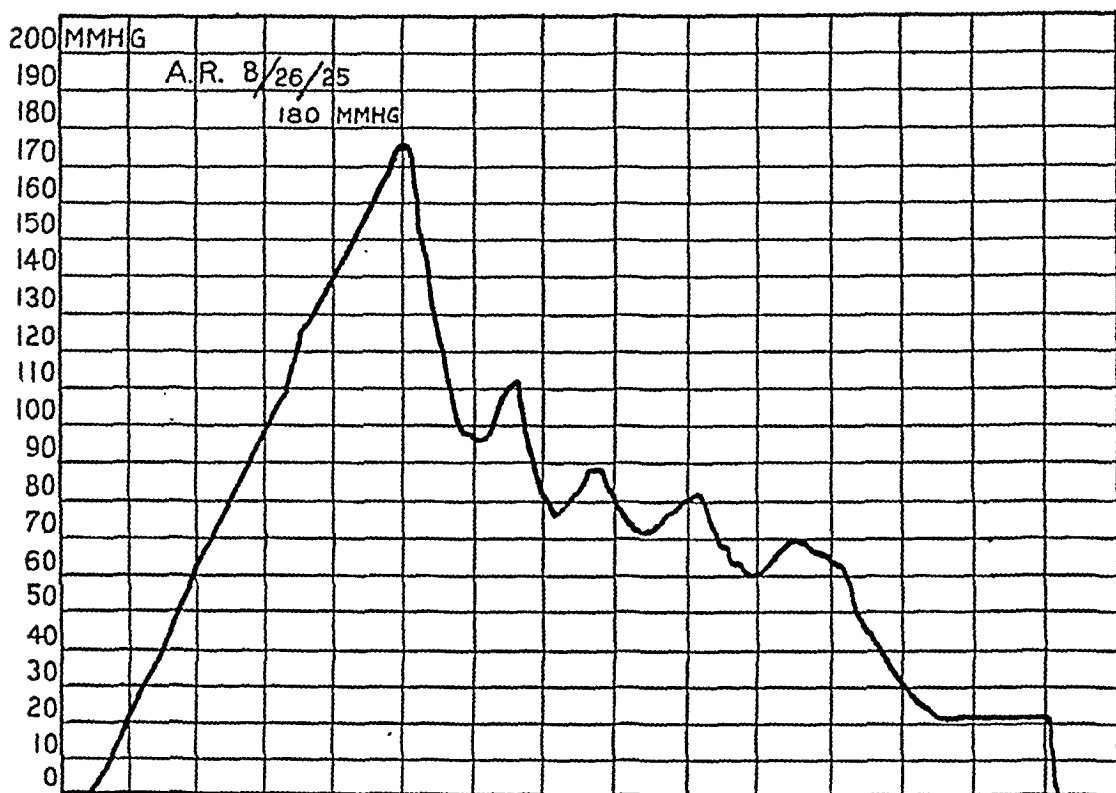


FIG. 133.—KYMOGRAPHIC RECORD DURING UTEROTUBAL INSUFFLATION IN PRESENCE OF TUBO-UTERINE SPASM.

shut off. If a drop of the mercury is noted, not due to regurgitation from the cervical canal, it indicates a possible tubal spasm or the overcoming of an exceedingly narrow opening at some portion of the tube. Radiographic examination may demonstrate distention of the tube where the stenosis is near the fimbriae or at the ampullar portion. Vaginal palpation immediately after insufflation may demonstrate a distended tube which a few minutes later becomes impalpable. Auscultation over the lower lateral abdominal areas, as suggested by Henderson and Amos (*J. Am. M. Ass.*, 1922, 78), may distinguish the high-pitched note of stenosis from a lower pitched note on the normal side. The fluoroscopic examination or Roentgen film must show the presence of gas under the diaphragm. In favorable cases, the distended tube can also be demonstrated, as Meaker has shown. If the gas on a second examination

peritoneal cavity freely and at a lower pressure, it is safe to assume that the fallopian tube was in spasm at first. Recently with the kymograph the most striking differential point was brought out, demonstrating that in the presence of spasm and immediately after it has subsided, curves are described typical of tubal peristalsis. These are absent in the stenosis of organic stricture due to pathological alterations in the walls of the fallopian tubes.⁴

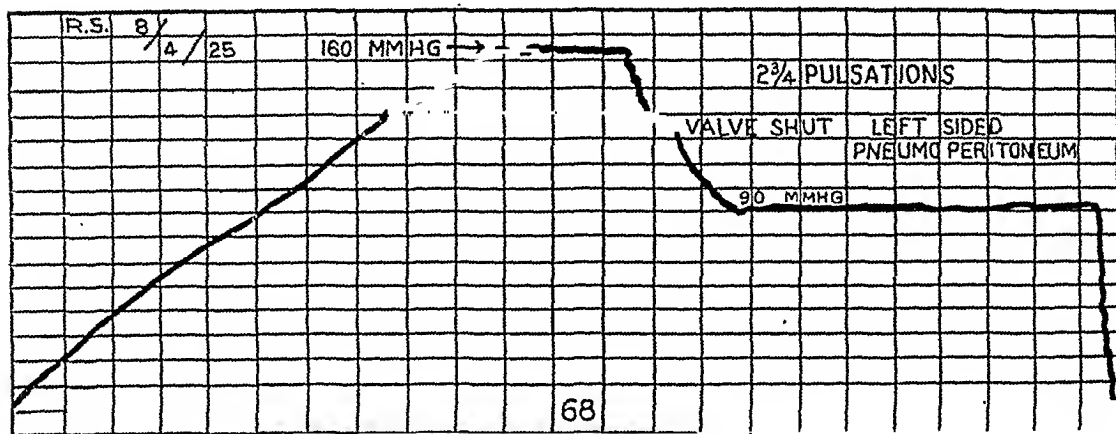


FIG. 134.—KYMOGRAPHIC RECORD DURING UTEROTUBAL INSUFFLATION IN PRESENCE OF STRICTURE OF TUBES IN CONTRADISTINCTION TO SPASM.

Compare with Figure 133.

Repetition of Test.—When the tubes are found normally patent, another test is not necessary. If a subphrenic pneumoperitoneum is not produced the first time, however, it is well to insufflate again after a month. Several trials may be made at one examination, but it is better to wait. Three or four tests have been made at the same relative date after successive menstrual periods, and a fifth or a sixth attempt can do no harm when the patient is anxious for a therapeutic result. The same careful physical examination should be made before each insufflation, excluding tenderness or inflammation. Several patients, found to have tubal patency on a fourth test, subsequently gave birth to normal children. The second and third tests were to corroborate the original findings and to establish a more reliable prognosis. The indication for a plastic operation upon the tubes may also be clearly established.

Effect upon Menstruation.—The occasional slight staining following the insufflation for a day or two needs no special attention.

The next menstrual period may appear two or three days early, but its duration and normal character are practically unchanged. Peterson and Cron (*J. Am. M. Ass.*, 1923, 81) have called attention to the relief of dysmenorrhea in some cases.

Further studies with the kymograph may help to establish peculiarities in the genital condition, which have hitherto escaped attention.

Therapeutic Value.—From the outset, it was obvious that insufflation might be of therapeutic as well as of diagnostic value.

Peterson and Cron, first to publish on this subject, state that "a number of patients examined for sterility by the Rubin test where the gas had been forced through the tubes reported pregnancy following without change of other conditions present during the time they had been desirous of children. This led us to send follow-up letters to all women in whom gas had been successfully forced through the tubes, omitting naturally those cases where our investigations had shown that the husbands were the cause of sterility. . . . At varying periods following the Rubin test, 13, or slightly more than one third of those women, became pregnant."

Thirty-six out of forty-seven replied to the questionnaire.

"Thirty women had never been pregnant. Six women had conceived earlier in their married lives. Since 4 of the 6 women who were relatively sterile became pregnant after the passage of gas through the tubes, while 9 of the 30 who were absolutely sterile conceived after the gas inflation, it follows that something more than the mere passage of the gas and mechanical opening of the tubes must be considered to explain the reason for the higher per cent of pregnancies in those who had previously conceived.

"Pregnancies in 10 went to full term. Three resulted in spontaneous abortions at the third month. The younger the woman, the greater will her chance of conceiving be. All but 3 became pregnant within six months after inflation (10 cases). Five had only one normal period. The shorter the period of sterility the more quickly pregnancy supervened. None of the cases who conceived were operated on after the inflation and no treatment was instituted."

Although not without personal observations, it was not until May, 1925, that Rubin was able to report to the New York State Medical Association upon ninety-five pregnancies in a thousand consecutive insufflations, his chief interest having been focused upon the development of the method more as a diagnostic measure. The analysis by Peterson and Cron of the pregnancies following peruterine tubal insufflation formed a basis for comparison with Rubin's experience, with patients reporting their pregnancies on their own initiative. A more careful inquiry may show more than 9.5 per cent.

It seems well established that the introduction of the gas through the uterus and tubes facilitates conception. A. J. Rongy (*N. Y. M. J. & M. Rec.*, October, 1922), among the first to note this, reported four pregnancies in 152 cases. S. R. Meaker (*J. Am. M. Ass.*, 1924, 82) reports three women married and sterile for two, four, and ten years, respectively, in whom pregnancy followed promptly. Two occurred two months after the test. In each, difficulty in forcing the gas through the tubes was encountered, accomplished at the first effort in two and at the fourth attempt in the third case. Meaker urges insufflation as a routine therapeutic measure in all cases in which e

RELATIVE STERILITY

One-child sterility	11
One child and one miscarriage.....	4
One child and two spontaneous miscarriages.....	2
One stillbirth	2
Two children by a first marriage.....	1
One or more spontaneous miscarriages.....	12
One or more induced abortions.....	5
Ectopic gestation	2
	<hr/>
	39

DURATION OF MARRIAGE

One year and under.....	14
Between one and two years.....	32
Between two and three years.....	15
Between three and four years.....	7
Between four and five years.....	11
Between five and six years.....	5
Between six and seven years.....	4
Between seven and eight years.....	5
Between eight and nine years.....	3
Eleven years	2
Fifteen years	2
Years unrecorded	1
	<hr/>
	101

Summary.—Peruterine insufflation is an aid in sterility:

1. It establishes patency of the genital tract from the external os to the abdominal opening of the fallopian tubes. Any cervical canal patulous to the uterine cannula used is ample for the entrance of spermatozoa. The cannula at the same time stretches the external os, rendering it somewhat more patent, and allows for freer drainage though only for a brief period. Should coitus take place shortly after the test, the spermatozoa have a better avenue of ingress.

2. A mucous plug, however, may be the real barrier, and its removal the important factor. In some cases it occupies the deeper portion of the cervical canal and is expelled after the insufflation and on withdrawal of the uterine cannula.

3. By separating mild agglutinations of the folds of the tubal mucosa, by straightening out tortuous tubes especially of the infantile type, by dislodging a mucous inspissation from a narrow to a wider portion of the tube, by actually separating adhesions at the fimbriated end, a way is opened for the ovum to meet the spermatozoa.

4. Although the nervous mechanism is not clear, there are responses to the physical stimulation through the psyche acting upon

nomie genital apparatus, possibly by relaxing otherwise spastic tubes. Rubin is convinced that spasm is common in the premenstrual or pregravid state and less frequent in the postmenstrual interval.

While the causes of sterility are often obscure, it is obvious that the mechanical factor of patency should be determined wherever possible. The method of insufflation of uterus and tubes with carbon dioxid gas, with the production of an artificial pneumoperitoneum, avoids a surgical exploration and is invaluable in obscure cases.

CHAPTER XII

DISEASES OF THE VULVA

RICHARD W. TELINDE

LESIONS OF THE SKIN

- Pediculosis
- Intertrigenous Dermatitis
- Vulvar Furunculosis
- Vitiligo
- Diabetic Vulvitis

INJURIES

CIRCULATORY CONDITIONS

- Varicose Veins
- Edema
- Angioma

VENEREAL AFFECTIONS

- Gonorrheal Vulvovaginitis
- Syphilis
- Chancroid
- Condyloma acuminatum
- Granuloma inguinale

TUBERCULOSIS

CHRONIC HYPERTROPHIC ULCERATIVE VULVITIS

BENIGN TUMORS

- Lipoma
- Fibroma and Fibromyoma
- Adenomyoma
- Hydrocele muliebris
- Inguinal Hernia

MALIGNANT TUMORS

- Carcinoma
- Sarcoma

VULVOVAGINAL GLANDS

- Cysts
- Abscess
- Primary Tuberculosis
- Carcinoma

LABIA MINORA

CLITORIS**Concretions and Adhesions****Cysts****HYMEN****Traumatism****Malformations****Neoplasms**

In that assemblage of tissues covered by the regional term "vulva," we consider the affections of the mons veneris, labia majora, labia minora, clitoris, outlet, and vulvovaginal glands, all with their varied liabilities to disease.

No other principle than contiguity unites these structures in their pathology which includes skin diseases, injuries, circulatory conditions, venereal affections, tuberculosis, hernias, cysts, and neoplasms—benign and malignant.

Surgically, the field is safe as the organs are superficial and accessible, and vital structures are distant. Hemorrhage, often free, is controllable by fine ligatures and buried sutures, while the superabundant movable adjacent skin readily covers defects due to the extirpation of tumors or an extensive vulvectomy.

The vulva also offers an admirable field for diathermic surgery, acusection, and coagulation, owing to the sterilizing properties of the current and the speedy granulations and the subsequent supple scar.

Lesions of the Skin.—Practically the only parasitic vulvar disease is the infesting *Pediculus pubis* or "crab-louse," often cultivated by the prostitute, which lies flattened on the skin and clings to the hairs. Owing to its salivary secretion, the skin acquires a bluish stain. Intense itching is its characteristic with resultant scratch marks. Diagnosis is readily made upon inspection, lice or their ova (nits) being revealed on the hair shafts. The parts should be shaved and ammoniated mercurial ointment (30 grains to the ounce) applied or bathed with a bichlorid of mercury solution, 1:500, twice a day. Shaving, however, with sitz-baths and cleanliness are effective, omitting drugs.

Intertrigenous dermatitis, the commonest of all skin lesions, particularly in obese women, is aggravated by hot weather and uncleanness especially when associated with a vaginal discharge. The skin is reddened and slightly roughened and old cases exhibit brown pigmentation. Treatment involves unremitting attention to cleanliness, sitz-baths night and morning using only a bland soap and water, careful drying, and the application of a mildly antiseptic powder, such as stearate of zinc.

Vulvar furunculosis, a fairly common malady, starts in an infected hair-follicle and spreads like acne in its regional distribution. The discomfort may even interfere with exercise. It is an obstinate malady which taxes the patience of both victim and surgeon. Shave the vulva and apply hot bichlorid compresses, 1:15,000, hastening maturation as well as preventing

the infection of other follicles. When pus forms, incise freely. Compresses of aluminum acetate 1 per cent are beneficial. An autogenous vaccine sometimes affects a permanent cure.

Vitiligo or leukoderma in irregular patches running out on to the thighs is extremely common on the vulva and in the colored race presents a striking picture, Figure 135. The skin of the affected area is smooth and unnaturally white in the central area from an entire absence of pigment which is massed and redeposited at the margins, sometimes forming striking black blotches. The surrounding skin is normal. The lesions are frequently symmetrical

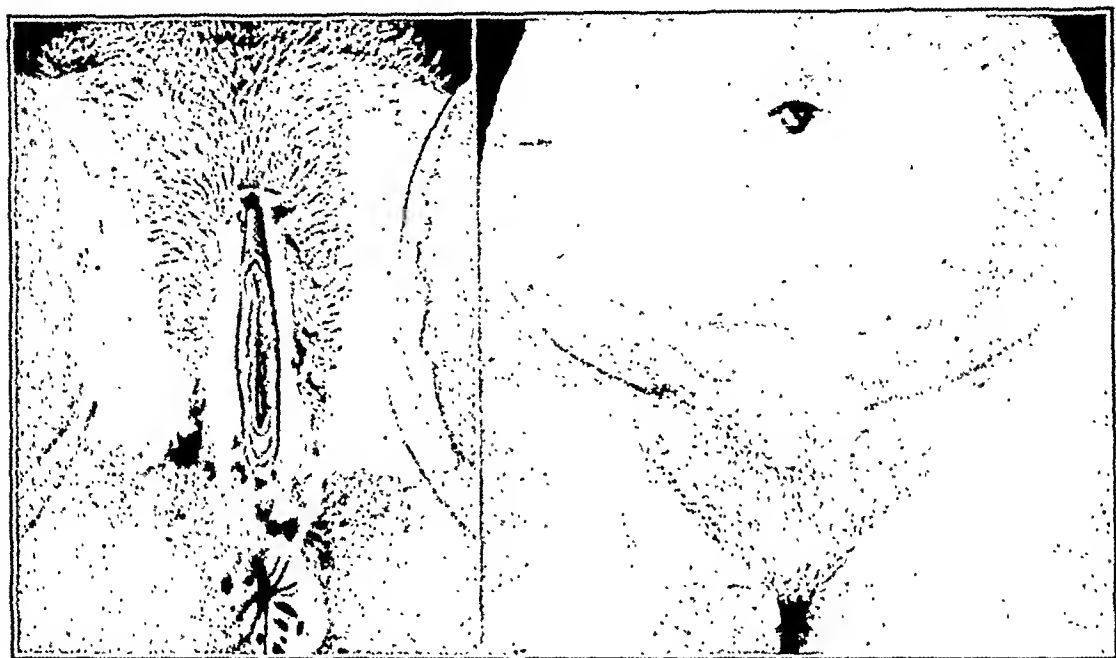


FIG. 135.—VITILIGO OF EXTERNAL GENITALS AND ABDOMEN.

Note deposit of pigment in blotches bilaterally symmetrical. (Jayle.)

bilaterally and probably central in origin. There is no necessary relation to syphilis; some endocrine disorder is believed to be responsible. It is sometimes a familial disease. Jayle emphasizes the importance of the general health. There is no direct treatment, as it is innocuous.

Diabetic vulvitis often accompanying diabetes mellitus is usually confined to the nonhairy parts which become dusky red. The itching and burning on urination are intense. It is important ever to bear in mind that any vulvitis or pruritus is likely to be but the outstanding warning signal of this systemic disease, and urinalysis is called for in all cases. The relief of the systemic trouble cures the itching.

Injuries.—In spite of an external situation, the vulva is so well guarded by its location and the protecting thighs, that it is but rarely injured by violence *ab externo*. I have seen an extensive hematoma from the kick of a brut husband. A girl of twelve entered the Johns Hopkins Hospital with a sex-

hemorrhage and a large hematoma of the perineum and left labium incident to a fall astride a fence rail on which she stood. Figure 136 shows a large hematoma, the result of a fall astraddle a chair. There are numerous instances of injuries to children from sliding down a balustrade and striking a

low newel post. Jacob Price of West Chester, Pennsylvania, was called to treat a vulvar laceration from a cow's horn, recalling the numerous extemporized cow-horn cesarean sections in the fields, collected by Robert P. Harris, where the cow proved a safer risk than the scalpel.

Injuries from violent coitus may be extensive but are more serious in the vagina.

Circulatory Conditions.

—*Varicose veins* of the labia majora are rather common in parous women. Although pregnancy is the chief factor, other contributory agents are prolonged standing, heavy work, and straining at stool. The varicosities of pregnancy usually shrink notably afterwards. While often symptomless, there



FIG. 136.—HEMATOMA OCCUPYING LEFT LABIUM MAJUS AND EXTENDING DOWNWARD ON TO THE PERINEUM.

may be marked itching and a sense of dis-ease and weight. Spontaneous rupture may occur, or a trauma may cause a free hemorrhage or a hematoma. The treatment in pregnancy is the recumbent posture so far as feasible. Temporary relief is derived by a pad held snugly against the parts by a T-binder. If the varicosities persist and are distressing, dissection and excision are the treatment, making an effort to locate the main trunks in the tissues adjacent to the swelling. Plenty of clamps should be at hand to limit the loss of blood. The hemorrhage will be less if the pelvis is elevated. In case of rupture, an ice-bag and pressure usually check the hemorrhage. The absorption of hematoma is hastened by rest and hot moist applications. Radium or x-ray ought to prove serviceable in effecting a cure.

Edema of the vulva in a marked degree occurs in chronic hypertrophic ulcerative vulvitis and in acute inflammation of Bartholin's glands (Chapter XXXIV). Extreme edema occurs in the generalized anasarca of cardiac and renal disease, infiltrating the loose connective-tissue structures. It is also seen in sarcoma in the pelvis and iliac fossa. It is symptomatic merely.

Angioma is rare, the majority being the nevi of children. Taussig reports a lymphangioma in a girl of fifteen, on a congenital nevus. If the case is early and the size and position permit, excision or ablation with the



FIG. 137.—MULTIPLE CHANCRES OF VULVA. (Taussig.)

endotherm coagulation current offers the best hope. Radium is also an efficient remedy.

Venereal Affections.—For *gonorrheal vulvovaginitis*, see Chapters XIII and XXXIV.

Syphilis is primary, secondary, or tertiary. Considering the frequency of luetic infections, the rarity of a primary lesion is remarkable, Figure 137. Being painless, it may lie hidden in the vulvar folds and is not infrequently discovered accidentally in the clinic. The typical primary sore is a superficial, round or oval erosion, surrounded by a livid areola, the base exuding a clear serum and bleeding slightly when wiped with gauze. There is a variable local edema and a definite induration less marked on a moist mucous surface. Chancres occur in every part of the vulva, observers differing as to the site of predilection; the fourchet and both labia majora are often involved. Multiple

chancres are commoner than in the male, due to the simultaneous inoculation of various abraded points and to a contact inoculation of opposed surfaces. A chancre is clean, indurated, and painless, while a chancroid is characteristically dirty and painful without induration. In both there is an associated inguinal adenitis with palpably enlarged glands. The glands of a chancre are firm, more or less discrete, and indolent, while chancroidal glands are tender, with local heat, and show a marked tendency to break down. *Treponema pallidum*, with its spiral form, in a dark-field examination of serum from the ulcer, certifies chancre. A negative Wassermann at this early stage does not rule

out a chancre, nor does a positive reaction necessarily signify a chancre, as a patient with chancroids may also have latent syphilis.

Secondary luetic manifestations vary with their location. *Condyloma latum* vegetates on the moist skin surfaces of labia and perineum, and the mucous patches are found in the vaginal vestibule. Flat condylomata form multiple rounded plateau elevations, with a moist grayish surface, Figure 138. The skin, usually intact, may become macerated and superficially ulcerated by the moisture and



FIG. 138.—CONDYLOMA LATUM.

Somewhat symmetrical arrangement of lesions due to contact implantations. (Taussig.)

form a secondary infection with a dirty discharge. Labia majora, perineum, and the perianal region are most affected, but the inner aspect of the thighs is not excluded from these painless lesions. Within the vestibule, secondary lesions appear, closely resembling those so commonly seen in the fauces; such are the moist papules or small shallow ulcers with a grayish-red base. The diagnosis is often confirmed by secondary manifestations elsewhere—skin eruptions, glandular enlargements, fever, and malaise. The broad condylomata and mucous patches abound in spirochetes. The Wassermann reaction is positive at this stage.

Gumma is rare and tends to break down and form a serpiginous ulcer with

a grayish-red base, occasionally migrating toward the rectum to form a fistula or toward the urethra to destroy it and cause incontinence.

The treatment of genital syphilis is that of the systemic infection.

Chancroid is due to an infection by the streptobacillus of Ducrey, found in abundance on the base of ulcers. The lesion, occurring anywhere on the vulva and commonly on the mucous membrane at the outlet, is a dirty, irregular, frequently multiple ulcer with undermined edges and a grayish-yellow base. The lack of induration forms a striking contrast to true chancre. It is extremely sensitive, dyspareunia

often occasioning the consultation, and is frequently accompanied by enlarged inguinal glands which show acute inflammation and usually soon become fluctuant. Cleanliness is of the utmost importance in the treatment; a thorough washing with soap and water twice a day is imperative. A daily douche, potassium permanganate, 1:5,000, also helps. Ulcers responding slowly are touched in their bases with pure carbolic acid followed by alcohol every few days; sparking the base thoroughly with a high frequency current hastens the healing. In the early stages, an ice-cap is put on the enlarged glands; when softening

is imminent, the process is hastened with heat. Later, free incisions and curettage are in order, or the interior is sterilized with diathermic coagulation.

Condyloma acuminatum, venereal wart, Figure 139, is an affliction of the uncleanly, accompanied by an irritating discharge usually gonorrheal. It is distinguished by "acuminatum" from the condyloma latum of syphilis. It appears as a papillary excrecence, single or oftener multiple, varying in size from a millet seed to a cauliflower cluster as big as a fist. Larger masses commoner in pregnancy decrease in the puerperium. The papillæ show a considerable hypertrophy of the epithelial covering, with a marked infiltration of the epithelium and connective tissue with round cells, plasma-cells, and polymorphonuclear leukocytes. The growths are common on the labia and frequently extend on to the perineum, thighs, and into the vagina. The lesion, in itself painless, may give rise to much discomfort when ulcerated.



FIG. 139.—MULTIPLE CONDYLOMATA ACUMINATA.
Entire lesion composed of a conglomeration of papillary excrecences.

The treatment depends on the extent and size of the lesion. The smaller growth should be touched and destroyed with the high frequency needle; it also yields to a guarded application of pure nitric or acetic acid. A larger growth is best excised; the endotherm acusector is admirably adapted to this purpose when the affection is not too extensive, local anesthesia sufficing. After



FIG. 140.—CONDYLOMA ACUMINATUM OR "VENEREAL WART."

More or less orderly overgrowth of squamous epithelium with papillomatous surface. Fibrous stroma very scanty. Round-cell infiltration less marked than often found. (J. H. U., Gyn.) $\times 10$.

removal, a general and local regimen of cleanliness must rule to prevent recurrence.

Granuloma inguinale was described by Conyer and Daniels in 1896 as found in the natives of British Guiana. Since then, many observations have been made in India, Africa, the West Indies, and South America. In 1912, Aragao and Vianna, of Rio de Janeiro, issued an exhaustive study with special reference to etiology and treatment. J. Grindon reported in 1913 the first case in the United States; others have occurred in New York, Philadelphia, Baltimore, Richmond, Sumpter, S. C., and New Orleans. With a single doubt-

ful exception, all of the instances found in the literature are in negroes, many of them natives of the United States never out of the country. Granuloma inguinale, therefore, is specially negroid in its predilection and upon this de-



FIG. 141.—GRANULOMA INGUINALE.

Negress, 22, always lived in New Jersey or New York. Duration three years. Wassermann negative; no result from antisyphilitic treatment. Donovan bodies present. Improved under tartar emetic. (Howard Fox.)

pend its geographical distribution. It is about equally prevalent in the sexes. Usually considered venereal, it is certainly less contagious than the older venereal diseases as it occurs in one married partner and the other is immune.

The history is that of a papule, generally on the labium majus, which rupturing and refusing to heal is followed by an overgrowth of exuberant, fleshy, red, clean, granulation tissue. The ulceration is progressive and often exten-



FIG. 142.—GRANULOMA INGUINALE.

Negress, 37, South Carolina. Ten months duration. Wassermann negative; no result from antisyphilitic treatment. Donovan bodies not found. Successfully treated by x-ray. (Howard Fox.)

sive, involving next in frequency to the labia, the perineum, vagina, groins, and thighs, Figures 141 and 142. The granulating area is covered with a thick, mucoid, nonoffensive discharge which if wiped with gauze leaves a clean, bleeding surface like healthy granulation tissue. The edge of the ulcer-

ated area is slightly raised; sometimes the vulvar edema although considerable is much less marked than in chronic hypertrophic ulcerative vulvitis. The lesion is not spontaneously painful nor much sensitive and so differs markedly from chaneroid. Burning on urination and discomfort from chafing in extensive lesions are common. Biopsy reveals nothing more distinctive than a superficial cellular area of young connective tissue with proliferating blood-vessels and abundant lymphocytes, plasma-cells, and polymorphonuclear lymphocytes, superimposed upon a denser connective-tissue area.

In 1905, C. Donovan (*Indian M. Gaz.*, 40) described a Gram-negative, encapsulated, intracellular organism uniformly visible in smears. In 1912, Aragao and Vianna cultivated a Gram-negative encapsulated organism resembling Friedländer's bacillus which they considered etiological, later repudiated by Aragao. Attempts to reproduce the cycle by inoculation are unsuccessful. The intracellular organism found with great uniformity is generally held to be pathognomonic. An admirable presentation of the subject with successful cultures is that of Alexander Randall, J. C. Small, and W. P. Belk (*Surg., Gynec., & Obst.*, 1922, 31).

They conclude that:

1. Granuloma inguinale is endemic in the United States.
2. Its diagnosis depends upon the characteristic local lesion, its marked predominance in negroes, and finding the specific organism described by Donovan.
3. The organism was demonstrated in smears from the lesions in twelve out of sixteen patients (in four there was no laboratory examination).
4. An encapsulated bacillus stained from cultures resembling this organism has been isolated from three of twelve patients studied culturally. This organism of the *Bacillus mucosus capsulatus* group appears identical with that seen in smears.
5. Treatment with tartar emetic intravenously acts as a specific. There is no contra-indication to this remedy up to doses as high as 0.1 gram.

Prior to 1912 the treatment was most unsatisfactory. In that year, Aragao and Vianna instituted the use of tartar emetic which acted rapidly and specifically. The technique as described by Randall, Small, and Belk is an intravenous injection on alternate days, beginning with 0.04 gram and rapidly increasing to a dosage of 0.1 gram. The average case heals in fifteen or twenty days. Aragao advocates a prophylactic weekly dose for twelve weeks longer.

Tuberculosis.—Vulvar tuberculosis is rare, with records widely scattered but admirably collected and summarized by Kenneth Bulkley (*Am. J. M. Sc.*, 149, No. 4), drawn upon freely for this section.

Up to 1861, seventy-one cases are recorded. In a series of 60 tubercles by nine authors, none are recorded of the vulva. Boi

attention to a relative frequency of vulvar tuberculosis in early childhood; it is commonest during the years of greatest sexual activity and is more frequent in lower social strata.

A potent factor determining a localization in the vulva is probably trauma or inflammation. It is found in association with tuberculous foci elsewhere, as in lungs, kidneys, and glands, but it also occurs apart from any other demonstrable lesion. The common cause of a primary vulvar tuberculosis is either sputum contamination or coitus. In a child of four and a half years, with no other localization, a playmate was found to have pulmonary tuberculosis. A child one year old with no other lesion was apparently infected by the mother's soiled linen. In eight genital tuberculoses in women, in five of which the bacilli were found, it was discovered that on the male side all had tuberculous epididymitis. It also arises as an extension from Bartholin's glands.

In seventy-two cases analyzed by Bulkley, internal genital lesions were mentioned in nine, tuberculosis of the uterus in five, of the cervix in five, of the tubes in four, and of the vagina in eight. In but three was tuberculosis of the kidney noted, and in one of the bladder; the intestine was involved in four and the rectum in five.

The localization is often unilateral, with labia majora and minora most frequently involved, the clitoris coming next. It appears as a hypertrophy, with and without ulceration, or as an ulceration without hypertrophy, and in fistulas and abscesses. In the hypertrophies, both skin and deeper tissues are involved.

A differential diagnosis must be made between tuberculosis and other chronic diseases with ulceration and more or less infiltration. Syphilis is first excluded by demonstrating the treponema and by the Wassermann reaction—always a *sine qua non*.

Bulkley says that the chancroid frequently seen about the vulva differs by its acute onset with more pain and inflammation and with a tendency to new lesions on contiguous surfaces, together with its common suppurative inguinal adenitis; the characteristic bacillus of Ducrey establishes the diagnosis.

Epithelioma differs in its raised edges and hard nodular borders. In suspected tuberculoses, sufficient tissue should be removed to demonstrate giant-cells and possibly tubercle bacilli.

As the disease advances continuously from its borders, it is often associated with other pyogenic organisms and an inguinal adenitis tuberculous or suppurative.

I agree with Bulkley that, in the first place, the disease must be held, as in epithelioma, to have extensions beyond the obvious margins, and that the cautery knife is a method of choice and better than the scalpel even though the destruction of tissue is extensive. My decided preference is circumferential by electrocoagulation and then destruction of the tissues over the affected area including a zone from 1 to 2 centimeters outside all

evident foci; the removal of the coagulated tissues is effected by the acusector and the underlying base is desiccated to leave a sterile field. If all the disease has not been wiped out at the first sitting, it is a simple matter to treat small recurrences in a subsequent sitting.

Infected inguinal glands should be treated with radium and if suppurating, incised, coagulated, curetted, and packed, or removed *in toto*.

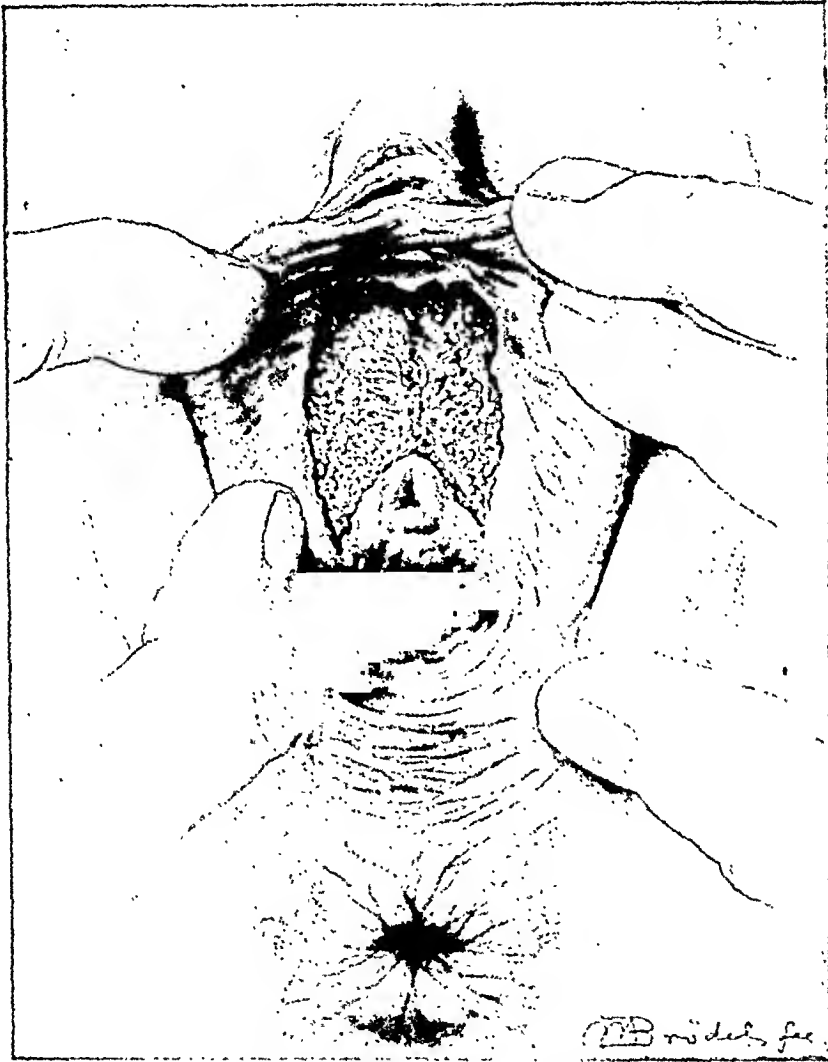


FIG. 143.—TUBERCULOSIS OF VESTIBULE.

Flat, pinkish, mammillated diseased area occupies entire vestibule. No thickening nor infiltration of edges which are raised about 2 millimeters above level of diseased area.

The prognosis in so far as the local trouble is concerned is excellent, the ultimate outcome depending upon the disease of the other organs—lungs, kidneys, and lymph glands.

Chronic Hypertrophic Ulcerative Vulvitis.—Under this caption suggested by Taussig is considered a group of cases, clinically inseparable, . . . ng under a variety of names in the literature, such as esthiomene, sy . . . rodent ulcer, and lupus. The objection to such varied terms is the imp . . .

of a specific etiology not yet demonstrated. Clinically and histologically, these affections seem to be akin. Aside from an infecting agent there are predisposing factors to which Taussig and others call attention:

1. A racial predisposition to fibrous hypertrophy, the incidence falling on negroes noted also for keloids and uterine fibroids.



FIG. 144.—CHRONIC HYPERTROPHIC ULCERATIVE VULVITIS.

Hypertrophy principally of left labium majus. Ulcerated area entirely hidden between two labia.

2. Uncleanliness. Practically all of the lower strata, many with a history of a neglected profuse discharge.

3. Interference with lymphatic drainage. Elephantiasis of the labia due to filarial infection seen in the tropics but practically unheard of in temperate climates.

4. Excessive sexual indulgence and prostitution.

Opinion is divided as to the infecting agent; it would appear that no single definable organism is responsible. There is clinical or serological evidence of

syphilis in 80 to 90 per cent (Taussig). Most, however, fail to respond to antilnetic treatment. Taussig believes, and it seems rational, that the ulcerations originate on the bases of syphilitic scars and that the spirochete is less a direct cause than the common pyogenic organisms and, therefore, objects to the implication of the term "syphiloma." W. B. Healy reports a culture of *Bacillus proteus* and a cure effected by injecting the vaccine after five years of other futile treatments. Occasionally, a lesion which seems clinically to belong to this group reveals the tubercle bacillus.

Symptoms are usually so slight that the doctor is not consulted until the vulvar mass is large enough to cause locomotor inconvenience. Mild itching, burning on urination, and dyspareunia are common. Discomfort on walking due to the size and weight of the vulva is often the chief complaint. The entire vulva may be uniformly enlarged or it may be limited to one or both labia or to the clitoris. The ulcerated area may be small and hidden in the folds, or so extensive as to overshadow the hypertrophy. At times the enlarged vulva is covered with small nodular excrecences. The hypertrophy must be carefully distinguished from a carcinoma. The best arbiter is the microscope in case of doubt; usually the difference is so obvious as to need no particular statement. A true fibroma is obviously a localized tumor, firm, circumscribed, and covered with a smooth skin devoid of ulceration. A sessile lipoma is free from any involved circumferential zone and the evidences of inflammation and lacks the brawny edema and ulceration. Granuloma inguinale is usually characterized by more marked ulceration and less edema, but at times it closely simulates hypertrophy. The Gram-negative intracellular organism may decide the matter.

Biopsy reveals a chronic inflammation; the granulation tissue of the ulcerated area is heavily infiltrated with lymphocytes, plasma-cells, and polymorphonuclear leukocytes. In the nonulcerated areas there is a marked increase in the connective tissue with round- and plasma-cell infiltration, the cells being usually arranged in islands, especially about the blood-vessels, which show some obliterative arteritis. Sometimes, giant-cells appear usually



FIG. 145.—SAME CASE SHOWN IN FIGURE 144 AT CONCLUSION OF COMPLETE VULVECTOMY.

surrounded by epithelioid cells; on the presence of these alone a diagnosis of tuberculosis is not justified. While the epithelium at the edge of the ulcerated area may show hypertrophy and dip into the underlying tissue, in the non-ulcerated region there is usually no change.

If there is syphilis, either clinically or serologically, antiluetic treatment is indicated. Local applications are valueless. Vulvectomy, partial or complete depending on the extent of the lesion, is best and quite uniformly results in cure. This can be done with the actual cautery blade, cutting out the

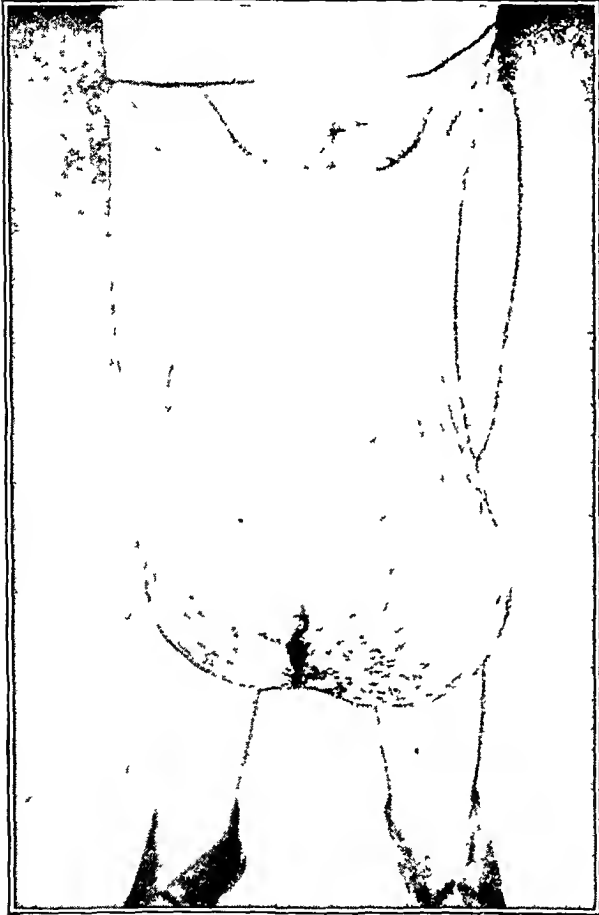


FIG. 146.—HUGE LIPOMA OF VULVA. (Lovelace.)

charred margin of the wound with a knife to secure better healing, or better yet with the high frequency current (Chapter XLVIII). Figures 144 and 145 show a typical case before and after a completed operation.

Benign Tumors.—*Lipoma*, or fatty tumor, is rare. In 1893, I collected twenty instances from the scattered literature, and, in 1923, W. R. Lovelace found fewer than forty-five. It is usually recognized with ease, either the whole labium is enlarged by the localized deposition of fat or the growth is sessile or, again, hangs by a more or less attenuated pedicle due to its weight as it pulls upon the yielding tissues in the erect position. The base may extend up into the inguinal canal and closely simulate a hernia or an encysted hydrocele. When I was a resident in the Episcopal Hospital of Philadel-

phia, in 1882, under A. K. Minick, I saw a tumor 8 centimeters long hanging like an egg from the middle of the right labium by a slender pedicle which was 5 centimeters long and about 3 millimeters thick. The patient mistaking my enthusiasm for so rare a specimen withdrew indignantly to some other clinic in spite of Minick's explanation that it was "*so schön*." William Goodell of Philadelphia saw one attached by a broad pedicle hanging down to the knees. Balls Headley of Melbourne removed one weighing 24 pounds, and W. R. Lovelace of Albuquerque, New Mexico, removed one from the left labium majus weighing 44 pounds, which reached the patient's knees.

The tumors are hard or soft according as the fibrous framework or the fat

predominates. With an excess of fat, the sense of fluctuation is so distinct that the inference that it is a cyst is almost irresistible. An exploring needle readily settles the doubt. With a predominance of fibrous tissue, the tumor feels like a fibroid growth, but the lobulation of the fat usually differentiates it. They develop slowly; the youngest patient was eighteen and the oldest, sixty-one. One woman had borne her burden for seventeen years. The chief distress is in walking and the marital function. A. Sturndorf had to excise one of the left labium majus of a primipara to secure delivery through the outlet obstructed by the broad-based firm tumor and an ankylosed right hip-joint.

The treatment by extirpation is easy, when the pedicle is small, under local anesthesia. Large sessile growths, sometimes formidable in their extent, are removed with more or less of the overlying skin, shelling out the fatty mass and leaving enough skin for closure.

Fibroma and Fibromyoma, although rare, are the commonest benign solid tumors in the vulvar region. V. Leonard found six in 23,000 gynecological admissions to the Johns Hopkins Hospital. They spring either from the vulvar connective tissue, the extraperitoneal portion of the round ligament, or the peritoneal areolar tissue. Composed chiefly of fibrous tissue, most of them contain some smooth muscle-fibers, particularly when they arise in the round ligament, in this resembling more closely the homologous tumors of the uterus. Figure 147. They originate in the labia majora, rarely in the labia minora or the clitoris. A round ligament growth appearing in the inguinal region growing down into the labia is likely to be mistaken for a hernia, an error corrected by noting the density, dullness on percussion, and irreducibility. Fibroids of the subperitoneal connective tissue are among the largest tumors reported.

The symptoms usually spring from their size and weight; there may be interference with coitus, locomotion, and micturition. When pedunculate, the blood supply is apt to be limited; they are then prone to the degenerations common to fibroids. Hyaline, cystic, calcareous, and sarcomatous changes have been noted. Over a fifth of those in Leonard's résumé had become sarcomatous. The treatment is prompt removal, best under local anesthesia.

Adenomyoma of the round ligament was first recorded by Cullen in 1896; others have been reported since. A lump like a fibroid appears, usually in the region of the inguinal ring. The growth is a compound of typical endometrium and smooth muscle. There is often a history of swelling with marked tenderness at the menstrual periods, which constitutes the chief point of differentiation between this and other benign solid tumors. Other rare endometrial growths may represent implants upon lacerations at labor. The treatment is invariably excision, which cures when the extirpation is thorough.

Hydrocele muliebri, a rare collection of fluid in the persistent (normal obliterated) canal of Nuck, appears as an elongate or moniliform tu-

tending from the external inguinal ring into the labium majus. The diagnosis rests on the location, the extension upwards toward the inguinal canal, and the fact that there is no communicated impulse or tympany as in hernia and that it gives rise to no characteristic symptoms. If the canal is patulous, the fluid will flow back into the abdomen to return again. The treatment is dissection

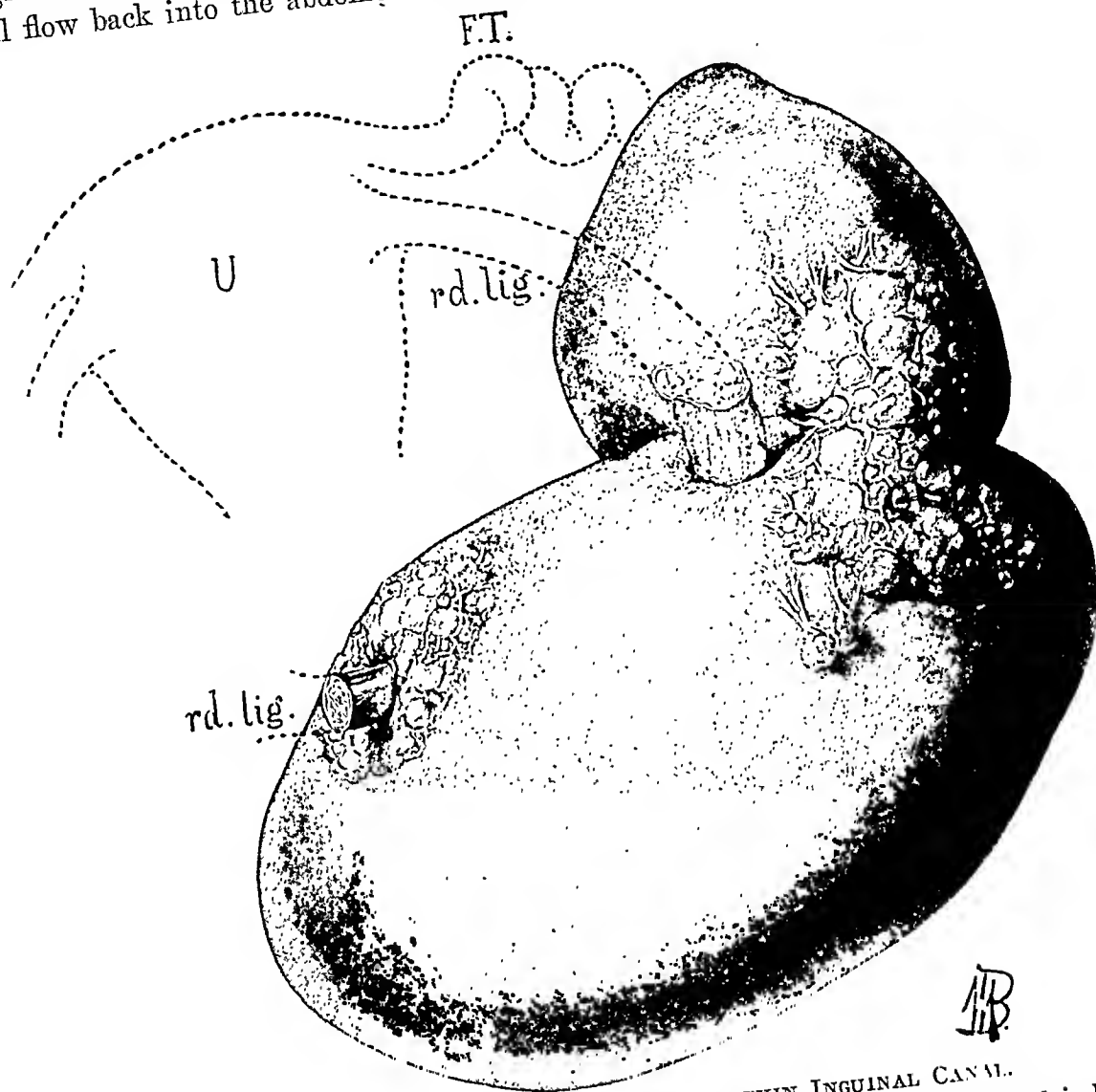


FIG. 147.—MYOMA OF ROUND LIGAMENT WITHIN INGUINAL CANAL.

Tumor consists of two masses, the upper having pushed its way down into pelvis behind peritoneum, the large mass filling canal. Diagram shows its relations to left round ligament.

and removal of the sac with closure of the external ring as a prophylaxis against hernia.

Inguinal hernia, although much rarer in woman than in man, appears at times as an inguinolabial tumor formed in a pouchlike extension of the abdominal parietal peritoneum into a labium majus, which may become so as to thrust the vulvar orifice well over to the other side. The sac contains intestines, omentum, or both. The diagnosis is usually readily made

upon observing the connection of the tumor with the abdomen and that it is tympanitic, gurgles on pressure, and can be replaced posturally with the patient on her back with elevated chest and flexed thighs in a position of relaxation, to descend again on standing and straining; it also yields an impulse on

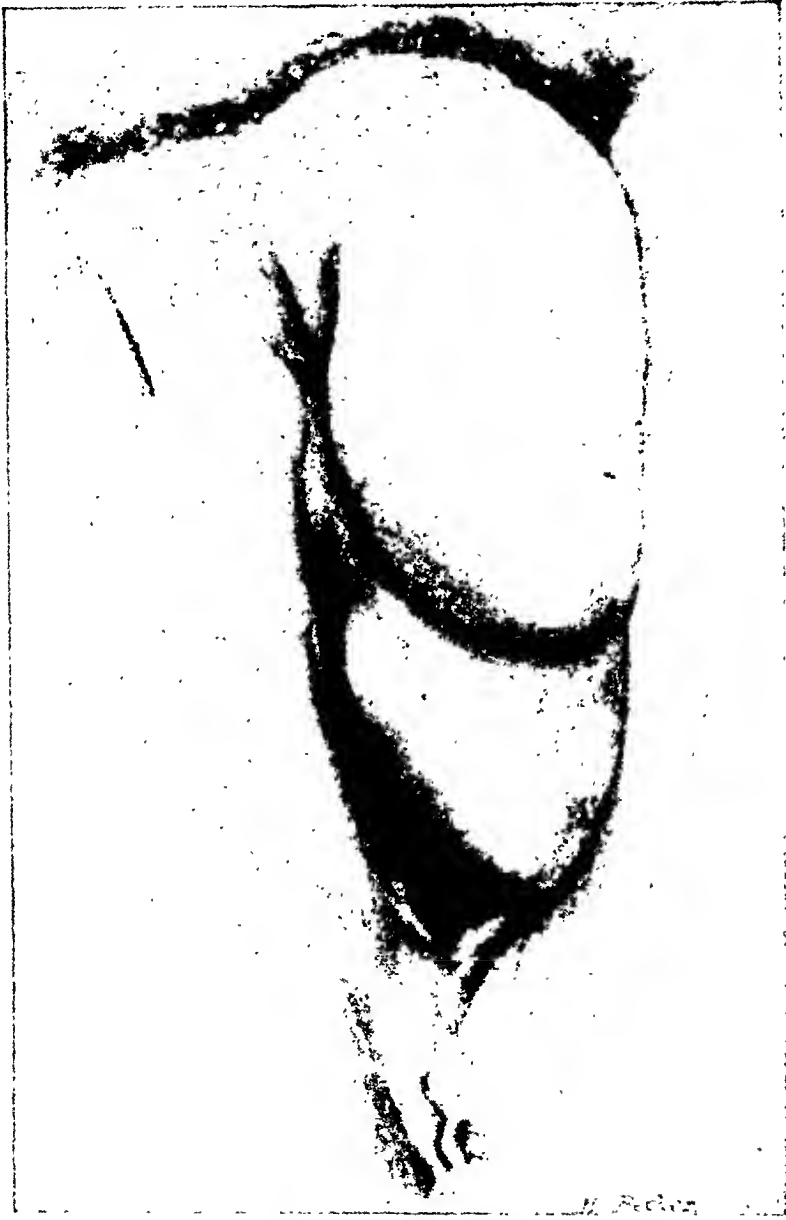


FIG. 148.—FIBROMA OF LEFT LABIUM MAJUS. (B. O. Coates.)

coughing. On replacement, the patulous canal ring is felt. A sac filled with an adherent incarcerated omentum is dull to percussion and more difficult to distinguish from a neoplasm or a fatty tumor which, indeed, in a literal sense it is. The treatment consists in the obliteration of the sac and the closure of the patulous ring with the reconstruction of the inguinal canal in details are given in standard works on general surgery.

Malignant Tumors.—*Carcinoma* is extremely malignant and found oftener in those of advanced years.¹ A. Giesecke, in reviewing the Kiel cases, found 56.8 per cent in women over sixty and 25 per cent over seventy; it is not, however, unknown in the twenties and earlier. It is usually grafted on to some chronic inflammatory lesion especially leukoplakia or the dermal changes of an old pruritus, as well as in kraurosis, Figure 149. It occurs in virgins (five out of twenty-three, *fide* Taussig), nulliparæ, and multiparæ, about equally in the last two groups. Carcinoma may be primary on any part of



FIG. 149.—CARCINOMA OF CLITORIS SPRINGING FROM EDGE OF CONDYLOMATA ACUMINATA.
Arrow marks site of cancer. (Taussig.)

the vulva and is commonest on the labia majora, the clitoris coming next. Histologically, the several kinds of cancer are squamous, medullary, and adenocarcinoma. The squamous type is found oftenest; it may take on the papillary or the ulcerative type, Figure 151. Adenocarcinoma is the usual form in Bartholin's glands.

Itching and burning are early complaints; pain usually comes late. In the early stages there is a slight serous discharge, becoming more profuse and blood-tinged as the ulceration progresses. When the urethra is involved,

¹Tausig's *Diseases of the Vulva* has been drawn on freely.

urinary obstruction or incontinence may occur. In an early stage, it is a well-defined hard, nodular mass, infiltrating the skin and then breaking down. Later there is often a massive involvement with secondary nodules and a brawny skin and frequent contact implantations. The inguinal and femoral glands are involved often early while the primary growth is small; these



FIG. 150.—SQUAMOUS CELL CARCINOMA OF VULVA.

1. Normal surface epithelium of vulva.
 2. Sebaceous gland near margin of wild overgrowth of epithelium.
 3. Under higher power, signs of rapid growth in individual cells.
 4. Ulceration with disappearance of surface epithelium.
- (J. H. U., Gyn.) $\times 15$.

metastases exist long before the hard glands are palpable: later, the conspicuous bunches above and below Poupart's ligament are obvious even to the patient.

Any doubt as to diagnosis should be settled by removing tissue with the endotherm needle for biopsy. There should be no delay in acting if there is any hope from an operation which is free from immediate risk.

The prognosis *quoad* permanency is grave but by no means hopeless. Gel-

erally speaking, the earlier the operation is done the better the hope; those which are unattached and therefore freely movable with their lax surrounding tissues offer the best chance for satisfactory extirpation. If there is one suspicious gland, it should be exposed and coagulated out of existence and left *in situ*. The question may well be raised whether a total gland extirpation on one, or in some on both sides, is not wiser as a uniform practice. Again the question is a fair one whether we can so completely extirpate the femoral and lower iliac glands. There is always a legitimate hope even when one or two enlarged glands are felt that they constitute at least a temporary block system. Where there is no hope of cure, much can be done by cleaning up the field as completely as possible with surgical diathermy, often bringing great relief to the distressing local discomforts.



FIG. 151.—PAPILLARY TYPE OF VULVAR CARCINOMA.
(Taussig.)

A. Giesecke, in 1921, reported a five-year operative cure in 31.2 per cent in thirty-two in the Kiel clinic. Taussig reports a five-year cure in three out of seven. These results tend to show that a complete vulvectomy is often best, with a radical lymph-gland dissection, inguinal and femoral, on the affected side at least and on both sides if the trouble is central as in carcinoma of the clitoris. The operation can be done in two stages if advisable. W. Stoeckel

even advocates extirpating iliac as well as inguinal and femoral glands. The question of the value of coagulation of the glands left *in situ*, a far simpler procedure, is sure to come up soon for settlement. The vulvectomy advocated is best done with the endotherm equipment. There is a far closer analogy between these vulvar growths and cancer of the breast, both with their early distant metastases, than between cervical cancer and the breast. For inoperable cases, however, radium locally and x-ray to the glands are useful as palliatives. Taussig rightly lays stress upon the prophylactic importance of the radical treatment of leukoplakic vulvitis as a precancerous condition.

A chronically inflamed clitoris ought to be extirpated with a wide margin of tissue until put under the microscope.

Sarcoma of the vulva is rare and occurs as melanotic and as nonpigmented. Spindle-, round-, and mixed-cell tumors are found. The nonpigmented may arise as a primary growth from the connective tissue or by metaplasia in a fibroma. The latter appears to be commonest from the histories of small, stationary, apparently benign growths which years later become malignant and grow rapidly. It is a disease of age, but the young are not exempt. I reported a myosarcoma in a twenty-six-year-old woman.

Melanotic sarcoma, usually after the menopause, arises in pigmented nevi. Veit in Germany, 1924, found this commoner than the nonpigmented. Both varieties are extremely malignant and cures but few (5 per cent, Veit). Radical vulvectomy gives the best hope.

Vulvovaginal Glands.

—*Cysts* and abscesses are common diseases of the vulvovaginal or Bartholin's glands. Discovered by Bartholin in 1680, Duverney pointed out in 1761 the resemblance of the gland tissue to the prostate, also mentioning the ducts opening in the vulva (*Œuvres anatomiques*, Paris, 1761, Vol. II). In 1850, P. C. Huguier monographed its diseases ("Mémoires sur

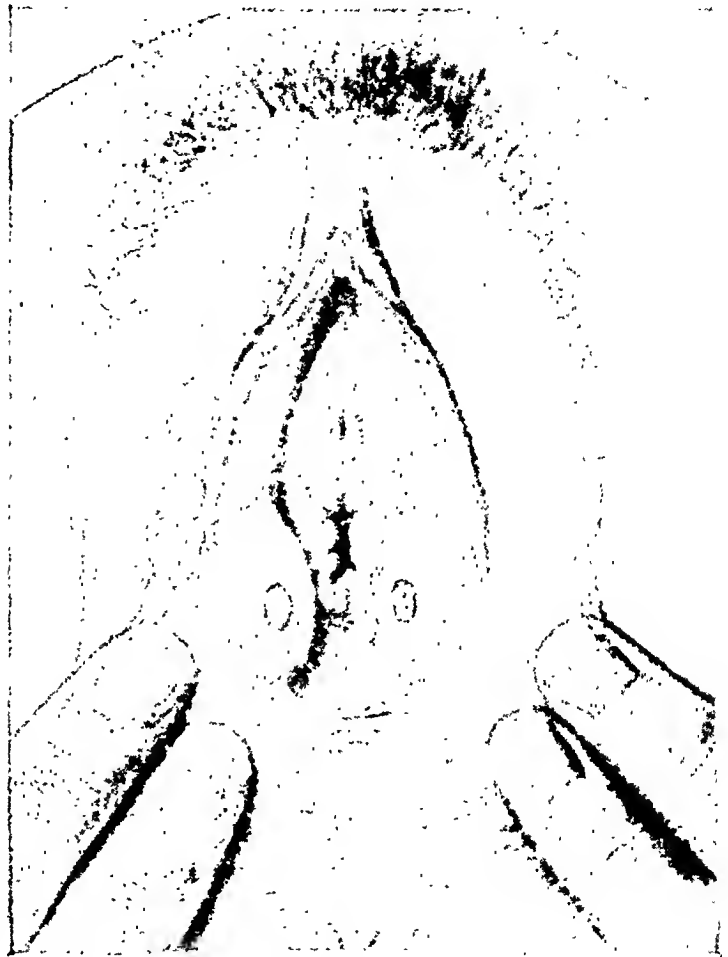


FIG. 152.—RELATION OF BARTHOLIN'S GLANDS TO VAGINA.

Both glands show inflammatory enlargement. Drop of pus escapes from gland on each side. Glands are in lateral walls, a short distance above fourchet. (Redrawn after Huguier.)

les Maladies des Appareils sécréteurs des Organes génitaux externes de la Femme," *Mém. de l'Acad.*, Paris, 1850, 15). In 1892, Müller reviewed the literature of the embryology, stating that the glands are first recognizable in a fetus 4.5 centimeters long as solid cords from the sinus urogenitalis.

The glands, two in number, lying in the paravaginal tissue, are the size of a pea, each with a duct on the inner or vaginal aspect discharging below and just outside the hymen. Occasionally the orifice can be probed. Perineal infection leaves it characteristically red like a flea bite and

sure forces out a drop of pus, Figure 152. In Figure 153, the relation of the glands to the vagina is outlined, the gland being pushed to one side by the cyst in the duct.

Normally the gland secretes a tenacious fluid like the white of egg. It grows rapidly in adolescence and atrophies in age. Its structure is seen in Figure 154.

The duct, about 0.5 millimeter in diameter at its exit, near the gland may be 2 millimeters. An inflammatory duct occlusion readily forms a cyst, com-

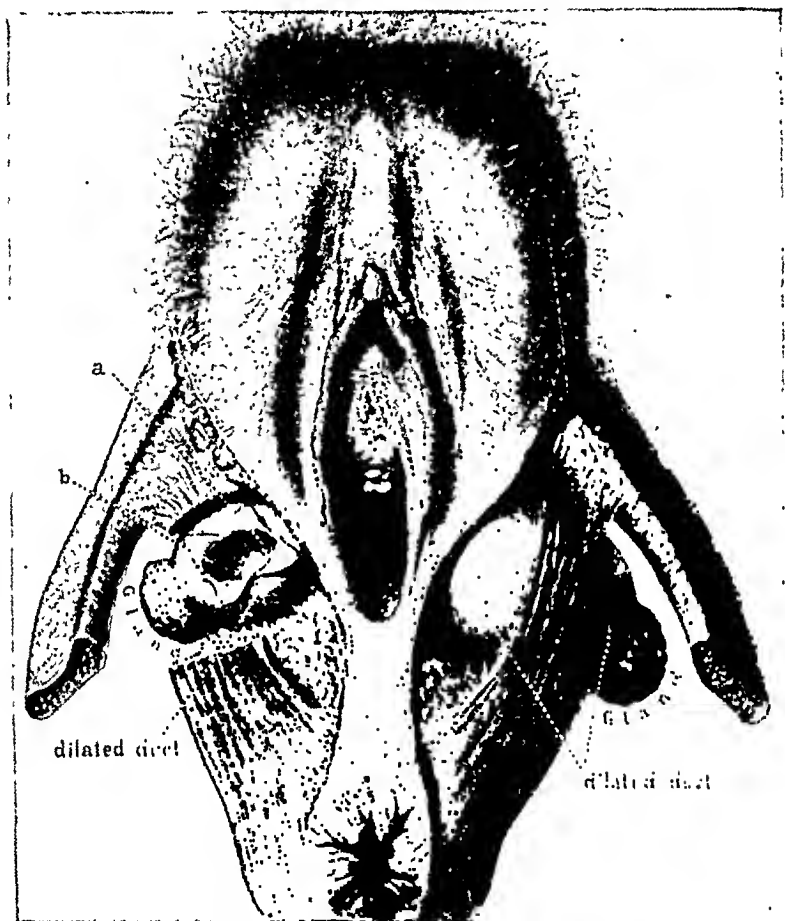


FIG. 153.—DEEP RELATIONS OF BARTHOLIN'S GLANDS TO VAGINA.

Normal glands lie in adipose tissue external to vagina. Here, both ducts have become cystic, displacing glands outward. *ab*, right duct open, showing sac within. (Redrawn after Huguier.)

mon in gonorrheal infection (90 to 95 per cent, Taussig); if the infection persists, an abscess follows. When secondary ducts are blocked, the main duct remaining patent, multiple cysts form.

The duct cysts are superficial, varying from 1 to 5 centimeters in diameter. The fluid is clear like the secretion or chocolate or yellowish after a hemor-

The inner surface is smooth, presenting here and there small sickle-shaped orifices of ducts, Figure 155. Clinically, the appearance of the common that of an ovoid eminence about the size of a pigeon's egg, which dis-

places the orifice to the opposite side, and there is often a history of a previous attack with spontaneous recovery. The discovery may be wholly accidental, as when a patient enters the hospital for a perineal operation.



FIG. 154.—SECTION THROUGH ENTIRE BARTHOLIN'S GLAND.

a gives clear idea of lobule composed of many small glands and partially separated by stroma from neighboring gland elements. At *b* are sections of this lobule's terminal duct. At *c* and *d* are sections of larger ducts.

The incidence is in the sexual period, rarely after fifty; in children it is probably the sequence of an unnoticed gonorrhea.

The treatment is either a free incision and evacuation with the destruction of the lining membrane by coagulation, followed by a pack and mild antiseptic applications such as a 2 per cent mercurochrome solution, or total extirpation and closure of the wound with a fine continuous catgut suture. The last is best where a vaginal operation must also be done, but it is always awkward. It seems best to extirpate the gland first and then to sew up the outlet later. All hemorrhage must be stopped to avoid a hematoma of considerable size. I once saw one with a 90 c.c. capacity and a big puddle of blood on the bed, causing a profound anemia.

A detailed report of this group was made by T. S. Cullen (*J. Am. M. Ass.*, Jan. 21, 1905). The youngest was seventeen and the oldest, fifty; the smallest was 5 millimeters, and the largest, 4 centimeters in diameter.

Abscess of the vulvovaginal glands commonly arises from gonorrhea 157. The youngest patient I have seen was sixteen and the

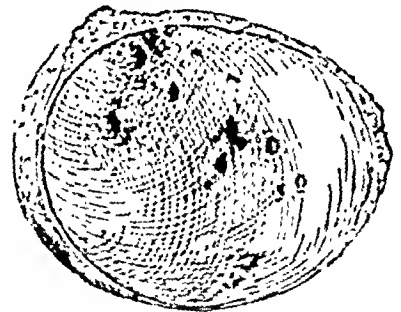


FIG. 155.—CYST OF BARTHOLIN'S GLAND.

Cyst is egg-shaped, with smooth inner surface, showing at numerous points dilated sickle-shaped or round openings of secondary ducts. $\times 1$.

thirty-eight. I do not believe that sexual trauma *per se* is a provocative agent in spite of the instances cited in the newly wedded to support the contention.

The onset is an acute throbbing pain with great local discomfort, swelling, and often edema, with a sense of weight on standing, painful locomotion, and



FIG. 156.—BARTHOLIN'S DUCT CYST.

Above is fibrous tissue removed with normal glass slide. The duct is somewhat dilated—less dilated than main duct cyst at (1) lined with cuboidal epithelium. (J. H. U., Gyn.) $\times 20$.

discomfort in sitting. The gait is slow and straddling with the body flexed. Chills and fever occur with extreme malaise. There is often an illuminating recent history of an offensive irritating leukorrhea with painful micturition. Examination of the pus is often negative for gonococci. The abscess reaches its height in a few days after perhaps several weeks of slow

progression and tends to spontaneous recovery by rupture on the mucous surface of the labium, discharging from 15 to 100 c.c. of blood, grumous or pure yellow pus. The exit is by one or more small openings which tend to close to be followed by a relapse. There is an occasional history of alternation of sides. Sometimes with no tangible enlargement, there may be a more or less constant seepage of pus.

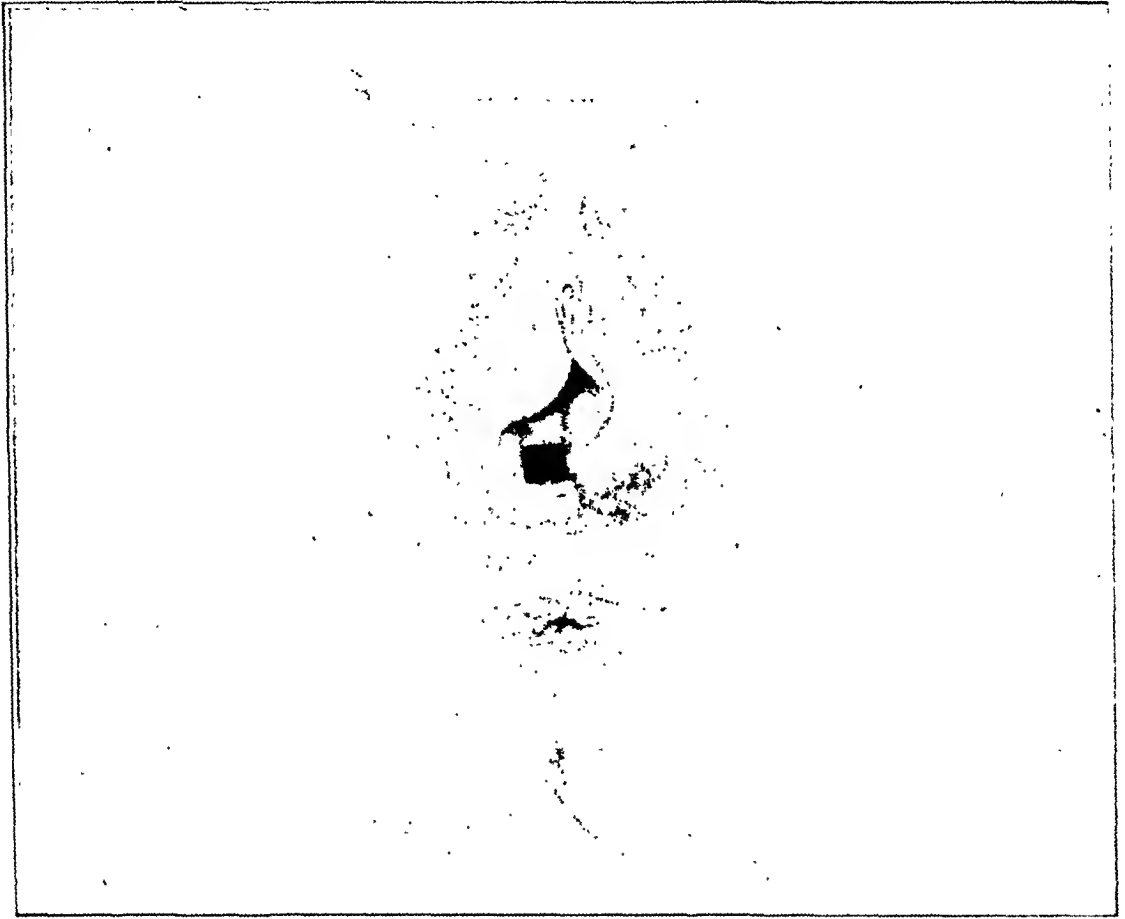


FIG. 157.—ABSCESS OF LEFT BARTHOLIN'S GLAND.

Distention is in direction of least resistance, out from left pubic ramus, partly covering vaginal outlet.

The diagnosis is easily made, associating the symptoms with the discovery of a tender fluctuating tumor in the lower part of one of the labia. A sac with thick walls and a small hard beanlike body deep in the labium, with no fluctuation, is likely to be overlooked. In one, these dense little nodules were clinically mistaken for malignancy.

These abscesses or their residua must not be confused with stereocornular abscess due to a rectal fistula discharging in the lower labium. We saw one in which the rectal communication was overlooked until it was cut. A rectal fistula is easy enough to recognize if it is not forgotten.

The treatment of abscess of the gland is by free incision, squeeze.

abscess empty and packing it. The whole inner surface should be destroyed by electrocoagulation. The incision is kept open until the cavity is obliterated; it leaves a fine linear cicatrix.

Where the abscess is a small indurated nodule with a little pus in the center, the best treatment is exposure by a linear incision and electrocoagulation,

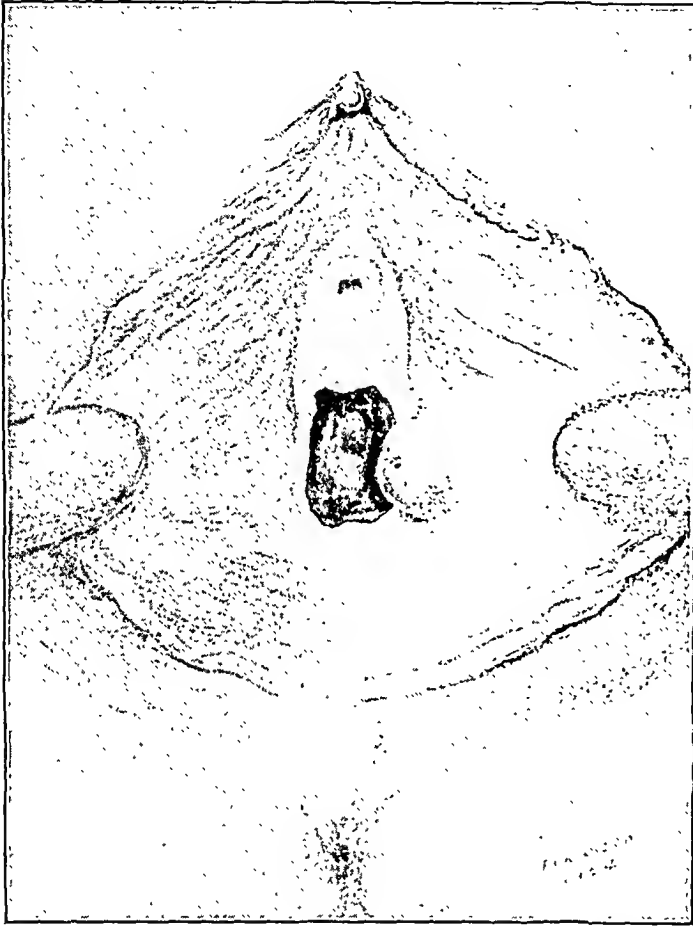


FIG. 158.—NODULE OF TUBERCULOSIS OF BARTHOLIN'S GLAND WITH PINHOLE SINUS.
(J. Whitlock Gordon.)

destroying the gland in its entirety. In one case, the gland came out piecemeal, owing to its intimate attachments to the infiltrated surrounding tissues.

Primary tuberculosis is so rare that J. Whitlock Gordon in 1925 could only discover three reported cases (*J. Am. M. Ass.*, 1925, 84). His own patient, aged twenty-four, had a nodule in the region of the left Bartholin gland, Figures 158 and 159, quite painful and with a small sinus with a thin discharge. She complained of much backache, a fullness in the rectum, and dyspareunia. Diagnosis — Bartholin abscess. The nodule and gland with débris were dissected out, in size about 4 by 4 centimeters by 12 millimeters. Pathological exam-

ination showed chronic tuberculosis of the gland with no evidence of the disease elsewhere.

Carcinoma of the vulvovaginal gland, Figure 160, is rare. In 1923, F. Falls found not more than twenty cases reported. The average age was 52.7 years. A swelling appears in the region of the gland, often painless but possibly extremely painful like an inflammation. It is firm and shows a tendency to fixation and breaks down early. Metastases occur in the inguinal glands. It is usually an adenocarcinoma. By reason of late discovery or incompleteness of operation, the outcome is lethal; one six- and one three-year cure are

treatment is a radical local excision with the inguinal lymph glands of the same side.

Labia minora.—Diseases involving the labia minora alone are rare. They are more likely to be involved in processes starting in the neighboring organs as in inflammatory conditions and in carcinoma. In a chronic hypertrophic vulvitis ("elephantiasis"), the labia minora usually form only an incidental part of a generalized process; occasionally, it is limited strictly to the labia



FIG. 159.—SECTION OF TUBERCULOUS BARTHOLIN'S GLAND UNDER HIGH POWER.
(J. Whitlock Gordon.)

minora. Hypertrophy of the labia minora of a noninflammatory type is occasionally seen and is often the result of masturbation. Cohesions occur between the labia minora of the two sides, usually in children, either congenitally from an inflammatory loss of epithelium followed by agglutination. Four have come under our notice, the youngest, only twenty months and the

six years old. The discovery was made by the mother (see Fig. 93). Figure 161 illustrates a group of symptomless innocuous multiple cysts from 0.5 to 2 centimeters in diameter.

Small sebaceous cysts produce a slight irritation calling for opening and sparking out with the endotherm under local anesthesia. I have removed

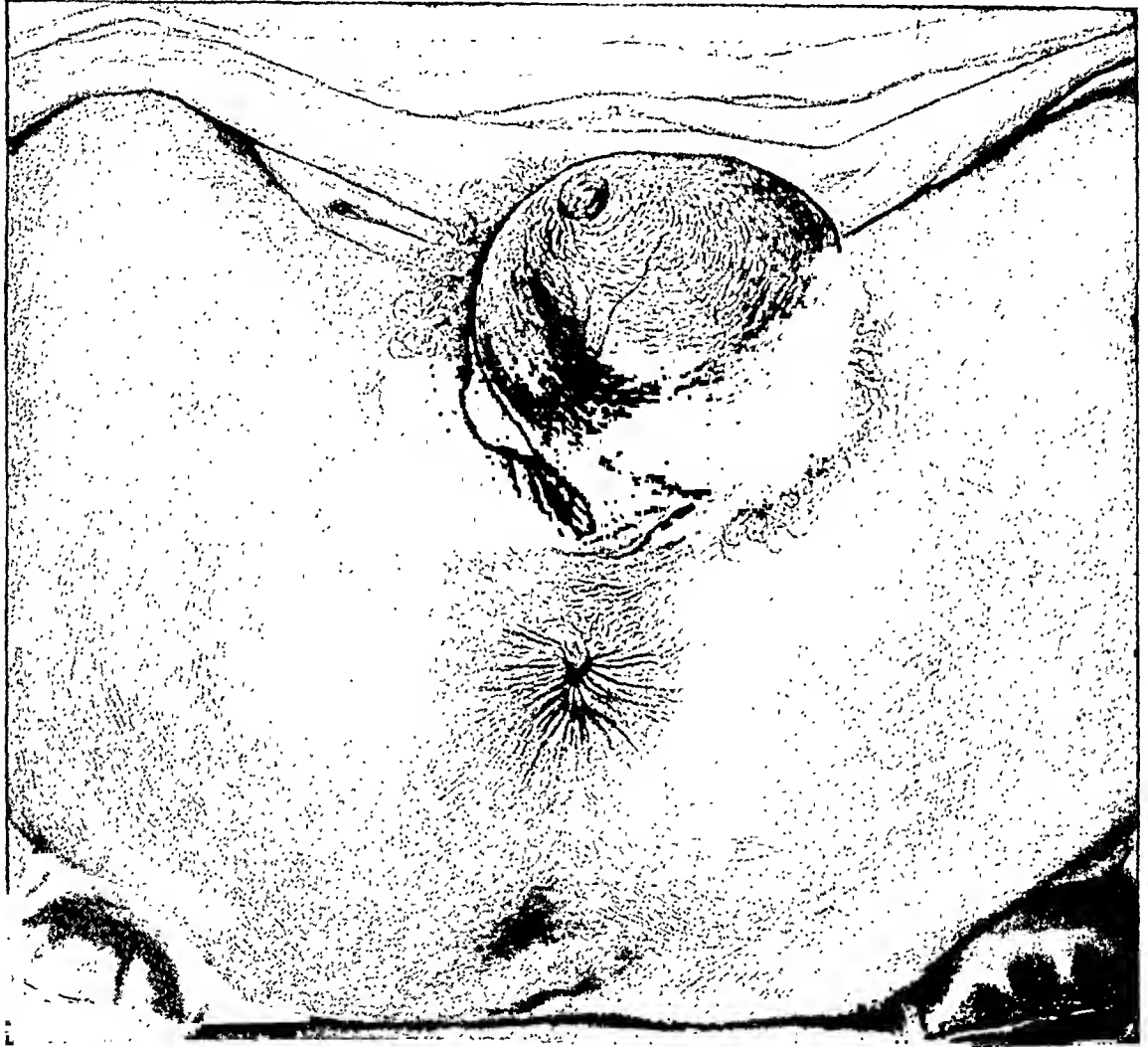


FIG. 160.—ADENOCARCINOMA OF LEFT BARTHOLIN'S GLAND.

Skin is thin, pores coarse and widely separated; a few hairs are scattered over surface. A large vein courses over right under surface, containing bloody fluid.

under cocain a small lenticular painful inflammatory mass from the upper right nympha, due to the contusion of a cycle seat. I have also removed a hard round symptomless fibroma of the right labium minus, 8 millimeters in diameter.

The treatment of all growths is simple, consisting in the excision of the labium.

is.—Concretions and adhesions between the glans and hood with smegma are common; the smegma sometimes causes considerable dis-

comfort and an inclination to handle the parts, which may result in masturbation in children and even in adults, Figure 162.

An inspection of the glans is a part of the routine gynecological examination; it is exposed by carefully rolling back its preputial covering and at the same time pressing in toward the symphysis when a semicircular corona of adhesions usually come to light, back of which are little beadlike accumulations of smegma.

I removed a large concretion, a source of irritation, in a woman of twenty-five, single, hysterical, and somewhat unbalanced, Figure 163; it was 1 by 1.2 centimeters and beveled off at its blackish exposed extremity. There is no occasion to touch the clitoris unless it is an obvious source of irritation. It is best to do the little operation under anesthesia, when the adhesions are freed with a blunt probe up to the exposure of the sulcus back of the corona which is cleared of all its smegma. The raw surface is covered with vaselin and the patient kept quiet if walking is uncomfortable. The prepuce is retracted daily for ten days and vaselin applied.



FIG. 161.—CYSTS OF LEFT LABIUM MINUS.

There is a curious tendency to draw attention to this minor complaint as of major importance, and an older generation will recall a brilliant reputation abroad beclouded by an irresistible impulse to perform "clitoridectomy." Aside from tumors, malignancy, and pruritus, the clitoris is not often a subject for operation.

Cysts of the clitoris are rare. Twenty-one cases were collected in 1907 by J. Strukowski (*München. med. Wochenschr.*, 1924, 71), reports a patient of sixty-five, 11.4 centimeters long and a circumference of 1.5 centimeters. I had occasion to remove a large cystic clitoris, Figure 1

brownish-yellow contents resembling a sebaceous cyst and numerous cholesterol crystals and epithelial cells.

Hymen.—The hymen, the membranous vaginal structure and barrier to the internal genital organs, between vulva and vagina, rarely requires surgical

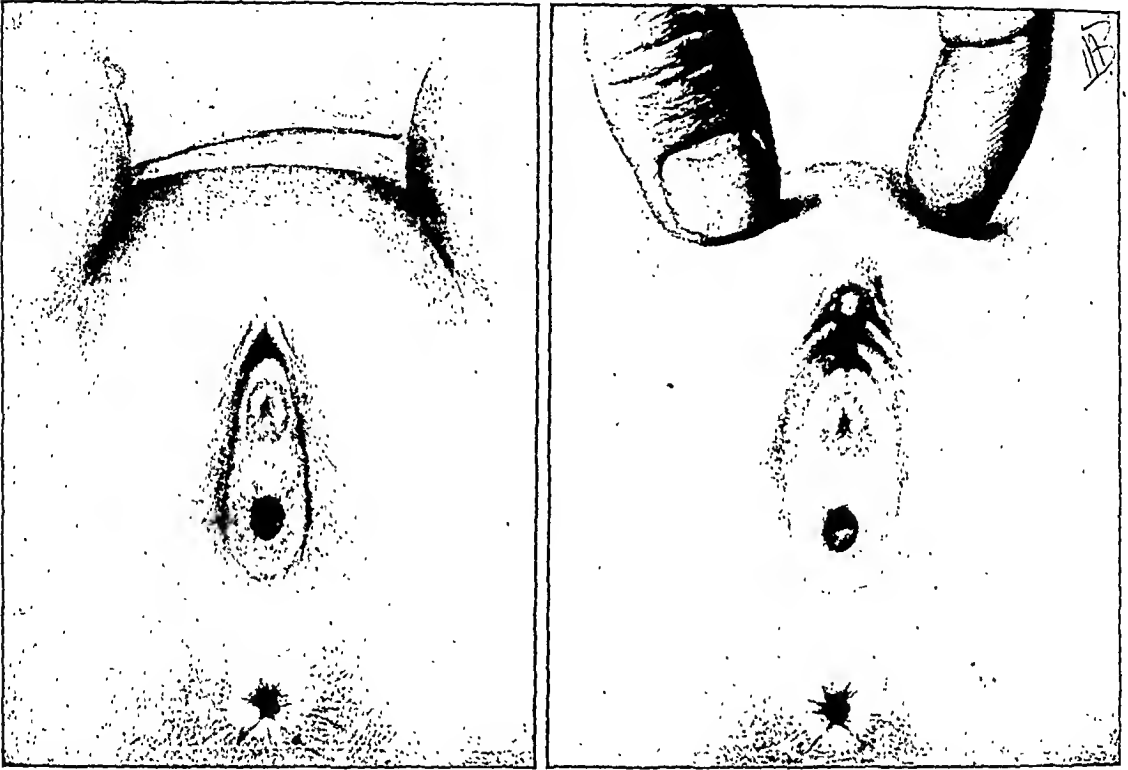


FIG. 162.—ADHESIONS BETWEEN PREPUCE AND CLITORIS IN A CHILD ONE YEAR OLD.

In the first picture the glans is completely covered by adherent prepuce; in the second, adhesions are broken and glans exposed and encircled by accumulations of smegma.

consideration. George Gellhorn has an admirable monograph on this structure ("Anatomy, Pathology, and Development of the Hymen," *Am. J. Obst.*, 1904). A microperforate hymen has but one or two minute openings, Figure 165, enough to permit the escape of the menstrual discharges. Where the hymen is tough it may prove to be an insurmountable obstacle in the newly wedded. A crucial incision best made under gas anesthesia quickly relieves the situation.



FIG. 163.—CONCRETION REMOVED FROM BENEATH PREPUCE OF CLITORIS. $\times 1$.

Traumatism.—Sometimes a deep tear is caused by the first intercourse and results in a copious hemorrhage necessitating a suture to check it. In violent or abnormal coitus, the tears are distinguished from physiologic injuries in that the adjacent parts are also always contused and injured. A young newly-wedded woman was brought to the clinic almost pulseless, with a deep hymeneal tear beginning in the left upper quadrant and extending through the para-urethral tissues to the base of the clitoris; there are many instances of fatal hymeneal hemorrhage. The

wound should be closed with fine sutures and intercourse interdicted for a time.



FIG. 164.—Ovoid Fluctuating Cyst of Clitoris.

Malformations.—Atresia, congenital or acquired, is the most important malformation and is often associated with anomalous development of all organs higher up. It is noted even in babyhood as a whitish sac

at the orifice when the child cries. An interesting observation has been reported by Madge (*Tr. Obst. Soc.*, London, 11:213), where four sisters, two to ten years old, had hymeneal atresia, while the fifth child, a boy, had phimosis.

After puberty, at each painful period, the secretions accumulate in uterus and vagina and form a dark tarry substance, greatly distending and filling the genital tract and opening up the external os until it becomes a mere continuation of the vagina. When the uterine tubes participate they are closed at the fimbriæ; these sacs fill up after the pelvic cavity.

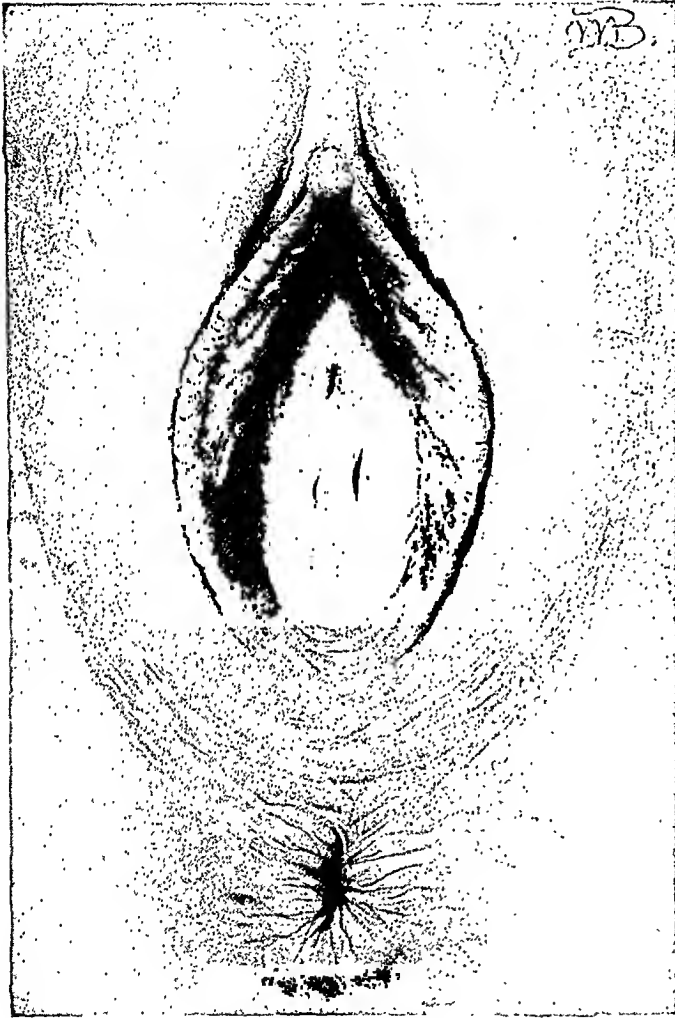


FIG. 165.—HYMEN INTACT AFTER NINE YEARS OF MARRIED LIFE.

Membrane thick and tough and perforated by two small orifices.

vessels, favors acute sepsis and gangrene which easily infect the peritoneum. The risk is best avoided by extreme aseptic precautions and by considering the entire tract within as absolutely *noli me tangere*; no gloved finger nor any instrument should be introduced however cautiously. The bulging membrane is excised in its entirety (W. P. Graves) and the thick tarry fluid allowed to flow out on to sterile gauze. All vaginal examinations are interdicted. The surrounding parts are painted with mercurio-

A diagnosis rests upon the imperforation and the accumulation about it easily felt rectally; sometimes it is large enough to fill the pelvis and obstruct the rectum and the bladder. A big tumor may even fill the lower abdomen and yield a wave of fluctuation from top to bottom. Great care must be taken not to rupture the thin tubal sacs, causing an almost inevitable fatal hemorrhage or peritonitis.

The treatment consists in opening and evacuating the sac or sacs and calls for extreme precaution as lives have been lost from foudroyant sepsis. The blood adhering to the sac and thin walls, together with the sudden removal of pressure from the blood-

chrome and an iodoform pad applied to the vulva. The dressing should be changed at every micturition.

On account of the danger of rupture of the hematosalpinx, Volt suggests opening the abdomen and extirpating the tubes before emptying the vagina and uterus; Graves believes it better to excise the hymen first and then to remove the tubes if they are distended.

Neoplasms.—Growths are rare. Cysts occur oftenest; Gellhorn has collected seventeen (*Am. J. Obst.*, 1901, 505). They appear on either side of the hymen, but more frequently outside and reach the size of a cherry; they are occasionally multiple. Inclusion cysts result from lacerations or coalescence of inflamed hymenal folds. Those lined with columnar epithelium are probably embryonic in origin. Simple excision effects a cure.

CHAPTER XIII

LEUKORRHEA

HOWARD A. KELLY

ETIOLOGY

DIAGNOSIS

PROPHYLAXIS

TREATMENT

Leukorrhea is one of those *omnium gatherum* terms, covering a multitude of diseases, which to the patient is the only sign of her malady and is, therefore, regarded as a disease *per se*. It is the thread which the gynecologist must take up and follow until he traces the trouble to its source and eliminates it by the appropriate remedies.

The vagina has naturally a slight secretion, acid in nature, by which it purges itself of the exfoliating particles of epithelium. The discharges calling for medical investigation are watery as from dropsical tubes intermittently pouring out a considerable amount of thin warm fluid; bloody as in cancer of the vagina or of the uterus; purulent and mucopurulent from gonorrhea, such forms of vaginitis as cervicitis in which a mucoid element largely predominates, and chronic endometritis; thin, foamy, and yellow when caused by *Trichomonas vaginalis*, emphasized by Gellhorn; and more or less offensive due to saprophytic or other bacteria associated with long worn, ill-fitting, or foul pessaries, contraceptive applications, and the breaking down of cancer.

The effect of such a discharge varies all the way from a slight irritation and reddening to an unbearable burning and itching of the external genitals. In gonorrheal vaginal discharges, especially in children, the distress produced by the irritation of the adjacent skin is often extreme.

Etiology.—The two most distressing forms of gonorrheal vaginitis are the contamination of the chaste wife and little children. The latter have attained an enormous importance within the past generation. Thousands of innocent little girls are infected yearly, probably largely in our schools. Flora Pollack, working in a special gynecological clinic at the Johns Hopkins, estimated from eight hundred to one thousand girls are infected yearly in Baltimore. The onset is apt to be slow, spreading over the tender mucosa of the genitals and persisting obdurately. Tubal infection seems to be rare as well as other serious complications, such as proctitis, arthritis, and ophthalmia. Gonorrhea is so common a cause of fluor albus that one must always bear it in mind to exclude or establish its presence. It is commonly the gonococcus that provokes the ropy, mucopurulent discharge from the nulliparous cervix, and it is

sometimes the underlying factor in this condition following childbirth. Almost without exception, it is the explanation of the irritating purulent discharge from the genitals of children: particularly is this true of those under institutional care.

Gellhorn emphasizes the importance of the *Trichomonas vaginalis*, a flagellate organism easily seen in a drop of the secretion diluted with normal salt solution under an oil immersion lens.

If a patient wears a soft rubber or an old encrusted hard rubber pessary, the cause is at once patent, and the malodorous infection is probably one of the saprophytic or of the pus-producing organisms.

A chronic congestion of the vaginal tissues following a radical extirpative operation sometimes is accompanied by a discharge from the vagina not of an inflammatory nature.

In the aged, a desquamation at the vaginal vault easily accounts for the discharge.

Exfoliative vaginitis, particularly studied by Gellhorn (*Am. J. Obst.*, 1901, 44), characterized it may be by discharge of a complete cast of the vagina, is provoked by the use of suppositories of dried alum plus an unaccounted for residuum of about 40 per cent: the latter according to my own impression is the drug jequirity. Gellhorn likens the detachment of this membrane to a perivaginitis phlegmonosa desiccans in which an abscess forms in the perivaginal tissues and spreads until it involves the entire vagina. A similar exfoliation is induced by painting the vagina with a 20 per cent nitrate of silver solution. Such a membrane must not be mistaken for a rubber cover sometimes accidentally detached in the vagina. One of these was once brought to Joseph Leidy by Hugh Hodge who was greatly puzzled as to its nature!

True diphtheritic vaginitis is seen in childhood and a streptococcus form in scarlatina.

A radical extirpation of tubes and ovaries is not infrequently followed by circulatory disturbance with a passive vaginal congestion which results in a thin distressing leukorrhea almost impossible to relieve.

There is a vaginitis of pregnancy associated with heat, redness, and swelling of the parts, with a peculiar curdy discharge and unbearable itching.

One of the most important causes never to be forgotten is the likelihood of the introduction of an infection by the physician with contaminated hands or by unclean instruments or through a pessary taken from a preceding patient and put with the stock without sterilization.

Diagnosis.—As the treatment varies according to the diagnosis, the first step is a thorough inspection to determine the source of the fluor. Pus oozing from the vulvar orifice should be examined both as to the degree of acidity and for bacteria, although aside from finding gonococci and trichomonads, one is not greatly helped by discovering colon bacilli, staphylococci, or other peccant organisms in a structure naturally so rich in its flora.

A whitish fungus growth may prove to be the sign of a diabetes.

Occasionally a diagnosis is clarified by passing a dressing forceps up into the uterus and opening it a little, revealing an intra-uterine source of fluor pyometra.

A digital examination may reveal a puffy tender vagina or an enlarged infiltrated everted cervix. Sometimes an unexpected source announces itself when the pelvic structures are manipulated bimanually and there is a gush of creamy pus from a pyosalpinx. This demonstration is enhanced by cleansing the vagina before making the bimanual rectal and abdominal palpation with pressure.

The next step is to inspect the lower genital tract either with a bivalve or a Nelson trivalve speculum, using only a little bland lubricant and avoiding carrying any confusing foreign material into the vagina. The speculum when opened first displays the cervix and the vaginal vault where the secretions often accumulate in a puddle. If a lacerated, infiltrated, and everted cervix is the source, a ropy, tenacious, mucous, or mucopurulent discharge issues from its canal, at once revealing the origin of the trouble and pointing the way to its prompt and thorough relief. If, on the other hand, the cervical canal contains only a little clear mucus in its orifice, the cause is not to be looked for either there or at any point above the vagina. As the speculum is withdrawn, the vaginal walls are examined for any redness, tumefaction, or localized patches of inflammation; ulceration is uncommon. The vagina is best inspected, however, and treated in the knee-chest posture through a Kelly conical speculum, Figure 72. In examining a child, use a vesical speculum 10 millimeters in diameter, in the knee-chest posture. Such an examination spreads out all the irregularities of the vaginal walls and affords a perfect view of the cervix and every part of the lower tract.

Of the several kinds of inflammation of the vagina, some three seem commoner, without reference to the underlying bacterial agent. These are a more or less uniform rosy redness of the entire vagina which may also be more or less puffy or edematous; again, there is a more marked inflammation and evident vascularity following the transverse ridges of the deployed folds; or, finally, scattered petechial areas appear looking like fleabites, a few millimeters in diameter without elevation.

Prophylaxis.—Much can be done with prophylaxis to obviate leukorrheas. The first step rests with the antiseptic conscience of the physician who scrupulously cleans his hands and makes his vaginal examinations wearing a thin rubber glove. Instruments must be washed and sterilized after use, and soft rubber pessaries rejected and only sterile hard rubber ones inserted. A great deal can probably be done to avoid the cervical form (cervicitis), with its rebellious profuse discharge, by suturing lacerated cervixes after labor, after needing investigation.

Perhaps the most important prophylactic care is against marital contami-

nation with gonorrhea by the general observation of rules of decency, morality, and restraint in married as well as in unmarried life.

The acme of prophylactic treatment may well be said to culminate in preventing vulvovaginitis in children (see especially Taussig, "Prevention and Treatment of Vulvovaginitis in Children," *Am. J. M. Sc.*, 1914, 148), which resolves itself into measures to inhibit the spread of the disease in families, among playmates, in schools and institutions where epidemics have been common. Taussig recommends examining a vaginal smear from all girls before admission to children's hospitals and homes and adequate facilities for isolation, special nurse, instruments, and linen and towels for infected children.

The source of infection in an appreciable number studied by Flora Pollack was the superstition that an adult can get rid of his gonorrhea if he can violate a *virgo intacta*. Where can he more certainly find a victim than in the cradle or near it?

F. J. Taussig is quite convinced that the transmission is from child to child especially through the contacts with school toilets. An excellent step in schools is the use of U-shaped toilet seats and a bowl not over 8 inches high. His comment is, "Gonorrhea in little girls is simply the result of inadequate sanitary precautions. The fact that hundreds of little girls are innocently infected with it every year in our large cities is a disgrace to the hygienic methods of the beginning of the twentieth century." For acute infections he recommends rest in bed with instillations of 25 per cent argyrol, supplemented by hexamethylamin 1:4 grains t. i. d.

Treatment.—The commonest plan of treatment adopted by the laity as well as by many doctors is the simple vaginal douche, which, although it acts as a detergent in washing away the accumulated vaginal secretions, rarely effects a cure, being at best but a palliative. A douche, therefore, must be looked upon simply as a valuable adjuvant. Convenient douches are a strong solution of common salt, say 2 teaspoonfuls to a pint of warm water, bicarbonate of soda and borax, a teaspoonful of each to a pint, or a compound menthol powder according to the formula:

R	Ol. Menth. Pip.....	5 jss.
	Phenol	5 iij
	Alum. pulv.	5 j
	Acid. bor.	5 iv
M.S.	One teaspoonful to one quart of hot water.	

If there is odor, a weak solution of permanganate of potash, a pinch of the crystals in a quart of warm water, is helpful.

When the disease comes from the cervix, the best and immediately effective treatment is a thorough cauterization, destroying the glands down to their bases, described in Chapter XVI.

Vaginitis emphysematosa or kolpohyperplasia cystica (Winckel) is ch.

acterized by little air cysts in the connective tissue and in the papillæ and by slight elevations on the mucosa containing fluid or air and giving rise to a sense of crepitation. It gives rise to no symptoms and does not require treatment as it passes off with the physiological condition.

Grouping the various vaginal diseases as one, I believe that the most widely applicable treatment is a thorough application of a strong solution of nitrate of silver (10 per cent) to all parts of the vaginal wall after removal of all secretions in the knee-chest posture, followed by douchings twice daily for about five days when another knee-chest examination is made and treatment given with a 2 or 3 per cent solution; after such a brief course the disease

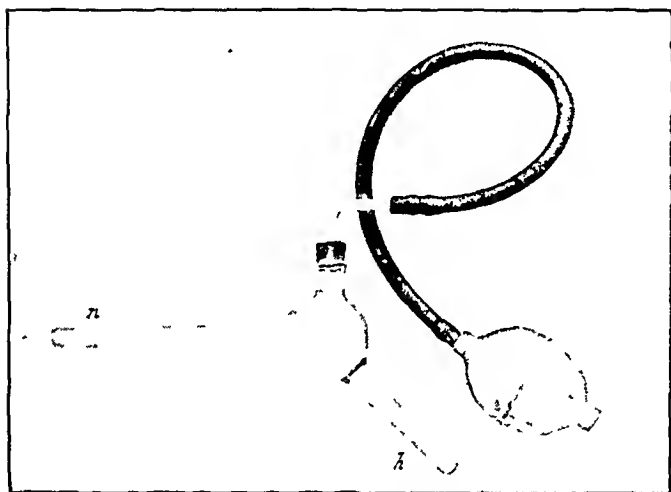


FIG. 166.—INSUFFLATOR FOR COATING THE VAGINA WITH A POWDER IN THE KNEE-CHEST POSTURE.
h. Handle. n. Nozzle.

is often greatly ameliorated or even disappears. There are those who rely much upon dry powder treatments, insufflating and coating the entire vaginal canal with bolus alba or kaolin which is hygroscopic and nonirritating. This can be conveniently impregnated with other remedies, such as acetate of aluminum, 20 per cent, ichthyol, etc. Gellhorn also recommends equal parts of a powder of kaolin and soda, treatments every few days in gonorrhea extending over a

period of four weeks or more. *Trichomonas* yields to 1:1000 bichlorid solution and a boroglycerid pack or to douches of a 5 per cent lactic acid solution alternated with an insufflation of kaolin with an astringent, say alum. W. P. Graves praises applications of the tincture of iodine.

Diathermy by a special vaginal metal applicator and violet ray given through a conical speculum in the knee-chest posture are valuable adjuvants.

The treatment of vaginitis by inserting tampons or packs, impregnated with glycerin, boric acid, tannic acid, etc., or other astringent and alterative remedies, is not so popular as in a previous generation when often there seemed little else to do in the gynecological dispensary and consulting room.

While there is a general objection to any topical applications whatever in acute gonorrhea, it is, in my opinion, advantageous to keep the parts free from the upper vaginal puddles of secretions by gently introducing a soft catheter, easily avoiding trauma, and then giving a prolonged warm or hot douche with a solution of boric acid followed by a weak silver solution 1:1000 or bichlorid solution or carbolic acid 0.5:1 per cent.

CHAPTER XIV

PRURITUS

CECIL W. VEST

ETIOLOGY

DIAGNOSIS

TREATMENT

Glycosuria; Glycemia; Syphilis

Cancer of Cervix and Body

Vaginitis; Endocervicitis

Thrush

Pediculosis

Worms; Lack of Cleanliness; Pessary

Masturbation

Eczema

Kraurosis

Excess of Cleanliness

Ray Therapy

Endothermy

Topical Applications

General Hygiene

Itching of the vulva regardless of the cause is called pruritus. Never an entity in itself, it occurs with or without manifest local changes. The term pruritus (never "pruritis"), therefore, is, like menorrhagia and metrorrhagia, symptomatic merely, and the first objective is to track the symptom to its source. All degrees of irritation are observable from a negligible or a periodic burning to a constant, persistent, irresistible, and maddening desire to scratch the parts, a source of never remitting distress all through the waking hours. An increase in body-temperature usually starts the irritation, and it is generally worse at night. There may be no skin changes in the milder forms, while in the chronic cases the skin becomes edematous, brawny, thickened, and madid. The attrition of contiguous surfaces serves to spread and to increase the unbearable irritation. The worst forms are often seen in the obese where an associated contiguous dermatitis is common.

Etiology.—In investigating pruritus, one must have in mind the numerous causes likely to be operative; one or other of the following will be almost surely found:

Glycosuria and glycemia
 Syphilis
 Morphinism
 Gonorrhea
 Leukorrheas
 Pessary
 Carcinoma of the uterus
 Pregnancy
 Menopause
 Menstruation
 Senile vaginitis
 Thrush
 Lack of cleanliness
 Excess of cleanliness
 Pediculi
 Masturbation
 Eczema
 Seat-worms
 Fistula in ano
 Kraurosis
 Leukoplakia
 Neurosis

H. M. Fenwick reported a case due to a vascular tumor of the urethra (*Australas. M. Gaz.*, 1884, 4).

Diagnosis.—One naturally begins with a full history of the present complaints and mode of onset, discriminating between the old and the young as the causes are diverse at the extremes of life. Pruritus is common in the obese who are troubled with an excess of secretions in the parts and less able to keep clean. The amount of itching is noted, intervals of remission, and exacerbations at night; also, whether the patient is much given to scratching, whether there is any leukorrhea, and whether douches are used. Remedies applied should be listed. Body habits as to food, exercise, bath, and bowels are elicited. Urine is early examined for sugar; blood, for sugar and for the Wassermann reaction.

The local examination reveals the condition of the vulva: Areas of skin and mucosa affected, discoloration, scratch marks, and rhagades, the broken vulvar hairs, thickenings of the skin with white or atrophic patches, any atrophy particularly of clitoris and nymphæ, pediculi or their nits. The perineal and perianal regions, or any fistula in ano also come under observation in the routine procedure. Urinary incontinence of any degree must be investigated.

The vagina is next examined as the source of any leukorrhea, for cancer of the cervix or the hypersecretion of lacerated infiltrated lips, cancer of the body, and endometritis.

Briefly, in approaching the diagnosis, one first makes a rough classification

and with the cases grouped in mind puts to himself these general questions, subdividing the groups into a few of the outstanding causes:

1. Is there any systemic condition likely to be responsible, such as syphilis, glycosuria, glycemia, or morphinism?

2. Is there any juxtagenital condition above the vulvar orifice: a leukorrhea, cancer of the cervix or of the body, endometritis, or senile vaginitis?

3. Is there an obvious local vulvar condition: thrush, leukoplakia, kraurosis, accumulations of smegma especially about clitoris, pediculosis, eczema, or furunculosis?

4. Is some transient condition operative as in pruritus at the menstrual period, at the menopause, or in pregnancy?

5. Is the rectum in any way involved?

6. The last thing to be admitted is a neurosis pure and simple.

Treatment.—The treatment is either palliative or radical, or both palliative and radical, according as the cause is more or less readily removable.

Glycosuria, glycemia, and syphilis naturally call for special treatment adapted to the underlying disease.

Cancer of the cervix and body giving rise to pruritus is easily relieved by the radical operation in appropriate cases or by curettage and a thorough local treatment, checking up the discharge.

Treatment of a *vaginitis* and particularly of an *endocervicitis* by cauterization often quickly eliminates this vaginal source of trouble.

Thrush, due to the *Oidium albicans* and common in diabetes and in women with low resistance, forms "diphtheritic" membranes surrounded by a zone of redness and affecting the labia majora and the exposed vaginal mucosa, the microscope revealing typical mycelia and spores; it is relieved by applications in the knee-chest posture of 25 per cent argyrol or 5 per cent nitrate of silver



FIG. 167.—MEMBRANE DUE TO DIABETES.
(J. H. H. Disp.)

to all affected parts, followed by a 50 per cent boroglycerid tampon, repeated at intervals of five or six days, using meanwhile mild antiseptic douches night and morning. It is also treated by a thorough cleansing with warm water and castile soap followed by a dusting with a dry powder:

R	Acid. Salicyl.	grs. ii
	Pulv. Camph.	grs. iv
	Acid. Bor.	5 vi
	Pulv. Amylum.	5 ii
M.S.	Dust on parts with a little pledget of cotton twice daily after careful cleansing.	

In the case of *pediculosis*, the simple shaving of the vulva and mons speedily removes the cause. Hot compresses of bichlorid of mercury 1:1000 also make an excellent remedy.

Other easily removable causes are *worms* in children, *lack of cleanliness*, a foul *pessary* provoking an irritating vaginitis.

Masturbation must be dealt with by moral suasion, coincident with careful attention to the local condition, removing minor sources of irritation, especially accumulations of smegma about the clitoris.

An *eczema* is best treated (Gellhorn) by drying the parts and using a phenol mixture:

R	Phenol	min. 30
	Liq.	min. 45
	Calimin. Praep.	grs. 90
	Zinc. Oxid.	grs. 90
	Glycerin.	5 2
	Aq. Rosæ	5 4

Or, a dry dusting powder, following which Gellhorn recommends nitrate of silver solutions 5 to 10 per cent weekly. He suggests as particularly useful in elderly women a preparation of tar:

R	Ol. Bet. Empyr. Rect.	5 1¼
	Ol. Oliv.	q. s. ad 5 2
S.	Rub in at night with a stiff brush.	

Kraurosis (Breisky) is a progressively atrophic condition of the introitus, due to a chronic inflammation of the epidermis and the corium. The labia majora become flattened out, and the labia minora disappear entirely or are indicated by a little flat fold. The clitoris is buried in the atrophic mucosa and the introitus is narrowed. The epidermis is thin, the elastic fibers destroyed, and the mucous surfaces white, gray-spotted, and atrophic. The atrophic condition with the contraction of the introitus differentiates this dis-

ease from other forms of pruritus. The symptoms are burning, itching, and a feeling of tenseness. Carcinoma is a not uncommon sequel.

In the early stages of kraurosis, it is well worth while to try radium combined with mild stimulating treatments of violet ray. When the disease is advanced, there is but one of two things to do, either a radical extirpation of

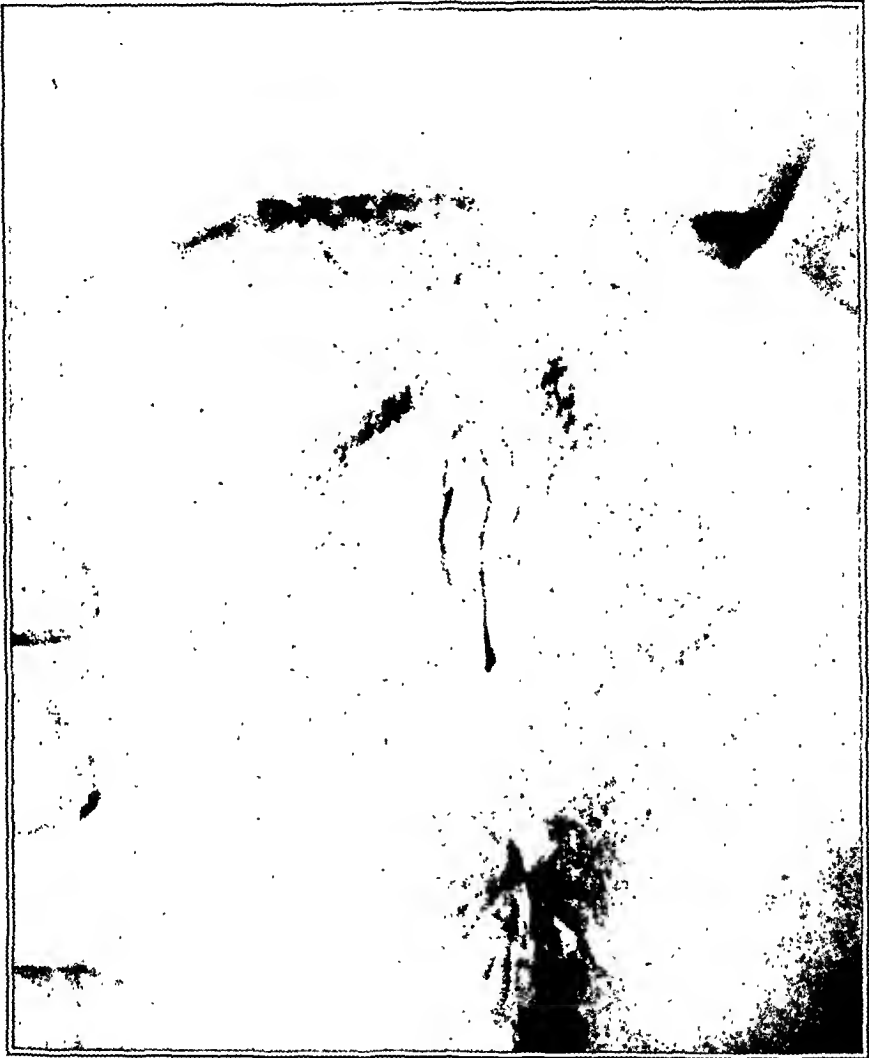


FIG. 168.—KRAUROSIS INVOLVING CLITORIS AND VULVAR MUCOUS SURFACES, EXTENDING DOWN OVER PERINEUM.

Extreme contraction of vaginal orifice.

all the diseased area or its destruction by the high frequency current. The latter plan has not, so far as we know, been tried but would be fully justified, judging by the now well-known effects of the current. The better plan would be to go over every area affected and destroy thoroughly the surface and then, using the aensector or the loop, to remove the coagulated debris, going deeper with further coagulation where necessary. Such an effective radical extirpation should be followed up with mild antiseptic dressings, hastening the healing after ten or twelve days by implanting pinch grafts. The expect

reasonable that even if the surface is not grafted the area will heal over forming a flexible nonsensitive scar.

A treatment of this sort is also applicable to any *leukoplakia* which proves rebellious to milder remedies.

A plan repeatedly used with success is the widespread excision of the dis-

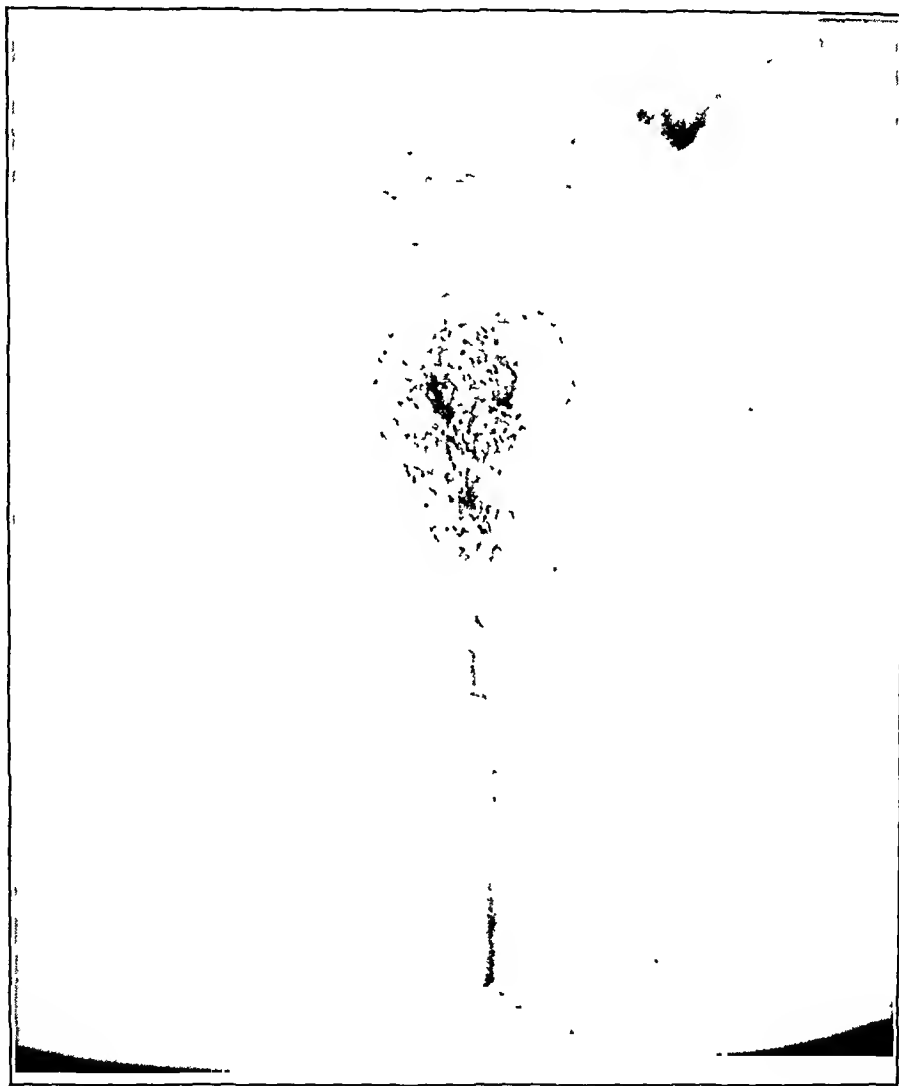


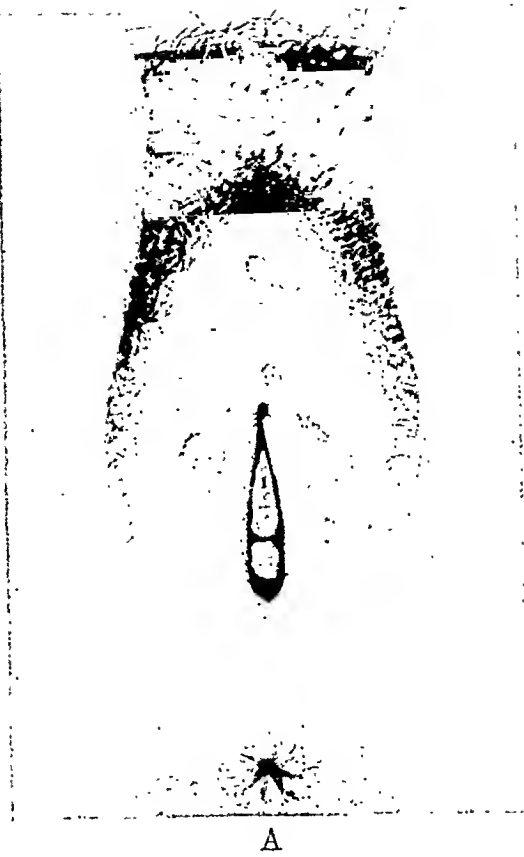
FIG. 169.—KRAUROSIS INVOLVING ENTIRE MUCOUS SURFACE, EXTENDING DOWN OVER PERINEUM TO ANAL ORIFICE.

Appearance after thorough coagulation of whole affected area, including clitoris and close to the urethral orifice.

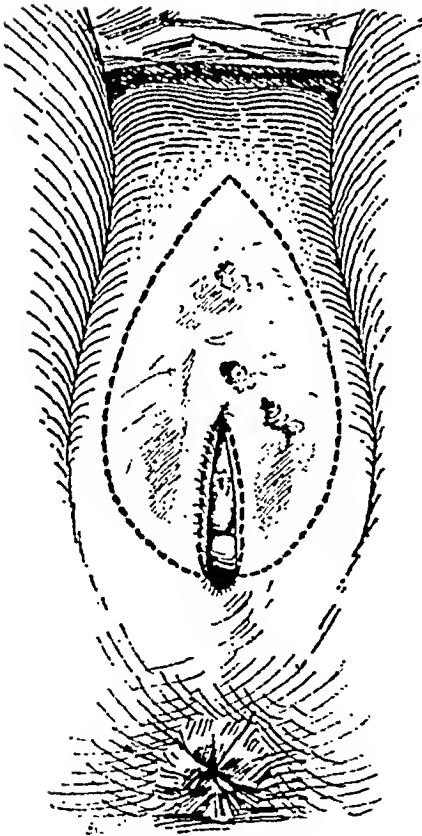
eased area, checking all hemorrhage and uniting the sound tissues as shown in the diagram, Plate I.

If the disease encroaches too closely upon the urethral orifice, confine the plastic operation to the circumferential area, destroying the disease around the orifice with the coagulation current.

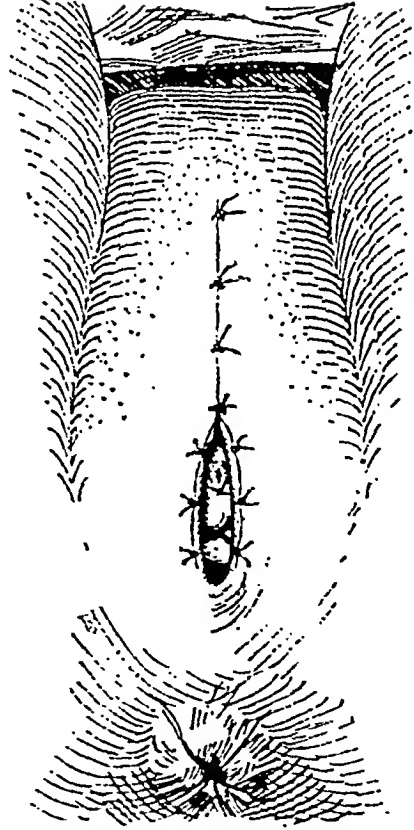
A mild pruritus without marked visible external alterations is sometimes



A



B



C

PLATE I.—PRURITUS VULVÆ

A. Pruritus occupying entire vulvar mucosa: whole area atrophic with whitish fibrous bands and reddish scratch lesions. Clitoris and labia minora not recognizable.

B. Dotted line representing area of excision of entire vulvar mucosa in operative treatment.

C. Operation as completed. Denuded area covered in by superficial interrupted sutures.

due to an *excess of cleanliness* and the use of an irritating soap, accompanied by considerable scrubbing of the parts, followed it may be by a liberal use of one of the legion powders offered at innumerable toilet counters. Such treatments often interfere seriously with the function of the sebaceous and sweat glands, dry the skin, and alter its texture. The habit should be abandoned, using only a bland soap, associated it may be with a slight radiation. Cases of this sort are often perpetuated by overtreatment and particularly by the use of salves. Lanolin is not infrequently irritating. A little group of these cases has come particularly under the care of C. F. Burnam.

Mild applications of *x-ray*, followed by the *violet ray*, are also valuable.

An excellent treatment in a rebellious case, when the local changes are not too great, and especially adapted to localized patches of pruritus, is the injection of an area with novocain followed by a thorough desiccation with *endothermy*, low voltage and high amperage whitening and destroying the superficial layer to the depth of 1:2 millimeters. The part is simply kept dry until the superficial epithelium separates, when a bland salve or a dry powder should be applied.

Other *topical palliative applications* are:

R	Pulv. camph.	grs. jv
	Menthol	grs. x
	Phenol.	grs. xxv
	Adeps. Lau.	̄ 5 j
M.S.	Apply externally.	
R	Cocain hydrochl.	grs. xx
	Adeps. Lau.	̄ 5 j
M.S.	Apply externally.	
R	Liq. plumb. subacet.	f ̄ 5 ij
	Tr. opii	f ̄ 5 ij
	Liq. calc. Hydrox.	f ̄ 5 vj
M.S.	Apply externally.	

William Goodell gives with approval the following prescriptions for topical use:

R	Chloral. Hydrat. } Camph. }	āā.....	̄ 5 jv
	Rub into oil and add:		
	Ung. Simp.		̄ 5 j
	Pulv. Acid. Bor.		̄ 5 jv
M.S.	Apply externally.		
R	Acid. Acet.		̄ 5 j
	Glycerin.		̄ 5 iij

℞ Sod. Bor. ʒ ij
 Morph. Hydrochl. grs. xx
 Acid. Hydrocyan. Dil. f ʒ j
 Glycerinæ f ʒ j
 Aq. rosæ ad f ʒ viij
M.S. Apply locally on a pledget of cotton.

Whatever local treatment is adopted, we must never omit such powerful adjuvants as *general hygiene*—a well-regulated diet and bowels, daily baths, a suitable resting period, say an hour after the midday meal, and tonics, as well as a modicum of exercise daily. In bad cases an occasional mild hypnotic will be needed to secure a good night's rest. Of various tonics and alteratives, arsenic is the best, combined with a simple bitter in pill form:

℞ Arsen. Triox. gr. ¼₀
 Ext. Calumb. }
 Ext. Gentian } āā..... gr. j
M. Ft. pil. i. Mitte tales No. 100.
S. One after each meal.

CHAPTER XV

DYSPAREUNIA

HOWARD A. KELLY

ETIOLOGY

Psychic

Mechanical

Inflammation of Genital Tract

Sterility

EXAMINATION AND DIAGNOSIS

TREATMENT

Dyspareunia, a difficulty in the marital relation, either hindering or preventing it, is fairly common in the experience of every specialist. It is always a source of domestic infelicity and sometimes causes a complete estrangement.

The term connotes a gamut of ailments, whether psychoneurotic, obviously mechanical, or inflammatory—many incurable, others capable of speedy and entire relief. Here as with menorrhagia, leukorrhea, and the broad question of pelvic pain, we take the patient's standpoint and endeavor to discover the particular efficient agency.

Etiology.—The *psychic* forms are: a sense of repulsion to contact which is natural in the unmarried and continues as nature's revenge into a marriage without love—portrayed in a scene in "Le Maître de Forges" by Georges Ohnet; notion that the relation is impure; an inexplicable aversion; homosexual perversion; memory of attempted violent defloration which developed antagonism; pathological fear of pregnancy; vaginismus or a nervous spasm of the constricting muscles of the orifice extending often to the adductors of the thighs, excited by marital approach. One also sees a neurosis during or after congress in the form of a distressing aching pain in the vagina, followed by lassitude lasting for some hours or longer.

Mechanical interference arises from an obstruction, more or less complete and prohibitory, at any point in or near the genital tract, extravulvar, vulvar, or vaginal. Such is a congenitally narrowed vagina due to arrested development.

A tough fleshy hymen not infrequently estops intercourse *ab initio* and through futile attempts results in a highly sensitive congested vulva; also, atresias of the vagina more or less complete, whether with a cicatrix at the orifice or a ring of contraction just within this or a marked narrowing further up.

Unusual development of the male organ may be a source of great distress, and sometimes the undue shortness of the vagina induces complaints from both sides.

External hindrances are: vulvar "elephantiasis," any large tumors of the vulva—whether lipoma or sarcoma, or even a tumor of the adjacent thigh.

Kraurosis becomes a late acquired cause, owing to the rigid fibrotic contraction of the introitus. A malignant infiltration of the vaginal walls with contraction and rigidity furnishes an effectual estoppage, and a large pessary, or sometimes even one of the common rings or a Smith pessary, occasions marital infelicity. A prolapsed ovary, either laterally or into the culdesac adjacent to the vaginal vault is a common source of trouble.

A vaginal cyst causes great distress as in a case cited by C. G. Child (*Sterility and Conception*, 1922):

D, age thirty. After birth of second child, a vaginal cyst grew rapidly and from size and tenderness prevented intercourse. Examination was made "only with considerable difficulty and much pain" in trying to reach the cervix. The cyst was aspirated and dissected out. There was a resumption of normal relations, and a child was born in three years after cessation of contraceptive practices. A myoma of the vagina acts in the same way.

Inflammations of the genital tract include ailments characterized by a focus of inflammation at some point from the vulva up to the pelvic floor peritoneum. Granuloma of the urethra, often seen, is characterized by a patulous everted orifice, exposing a swollen, reddened, painful area which often bleeds and is at times extremely sensitive. Caruncle, often diagnosed but in reality infrequent, is a neoplasm and not an inflammatory lesion, while yet conveniently placed in juxtaposition to granuloma for differentiation. The suffering experienced here on the least contact has become classic by the description of W. Goodell (*Clinical Notes*). Suburethral abscess, even of small size, in one of Skene's glands, is a point of great tenderness. An inflamed vulvovaginal gland, "bartholinitis," causes acute distress.

Exquisitely sensitive deep-red spots in the mucosa of the hymeneal ring are a fruitful source of dyspareunia—tender enough at times to make a vaginal examination impossible. Inflamed caruncles with or without these spots often stand guard at the introitus labeled *noli me tangere*.

A subacute gonorrhea may leave the vaginal orifice and the vagina so tender as to forbid marital approach.

A lingering pelvic inflammation is a common cause, seen in the prostitute and well-known to the ancients as associated with "*colica scortorum*."

A retroflexed adherent uterus, especially with a short vagina, is a source of distress.

Many dyspareunias are due to an inflamed ureter synonymous with the "neuralgia of our forefathers."

Dyspareunia is one of the complaints of the persistently *sterile* and when

it begins in the inception of marital life is apt to be psychio; it is rare in the parous. When acquired, the fault lies in an inflammation at or about the vaginal orifice, the vagina, or adjacent to the vaginal vault.

Examination and Diagnosis.—The patient who has an abnormal psyche or a neurosis as well as she who has developed some exquisitely tender spot in the neighborhood of the introitus, involuntarily shrinks from examination and makes every irrepressible physical effort to escape digital contact. In such an event, if a short time spent in giving assurance and making a gentle effort to expose the parts is unavailing, it will be best to examine under complete anesthesia which gas alone will hardly avail to bring about.

If the trouble lies above the orifice, the examiner proceeds until the painful spot is touched. "Le toucher," to use the gynecological phraseology of three generations ago, includes every part of the vagina for any sort of obstruction, with especial attention to the vesical area and particularly to the ureters palpated separately and distinctly felt through the anterolateral wall—a procedure we owe to Chrobak, Sänger, and Guy Humer.

The examination concludes with a vaginal and then a bimanual examination of the uterus, whether misplaced, adherent, or not, and especially of the ovaries, whether low down in displacement or adherent. Confidence and sympathy are especially needed in this group. As a rule, the patient will differentiate the difficulty as inside or outside, before or after penetration, early or late.

It must be noted that dyspareunia is rare in women who have been married long or who have borne children, and when it occurs in this group, it is due to an acquired cause, inflammatory or obstructive.

Treatment.—The psychic groups, including the neurotics, often marked by the involuntary spasmodic resistance and contraction of the muscles guarding the introitus, including the adductors of the thighs, technically termed vaginismus, remain one of our opprobria. The question may legitimately be raised whether it would not be wiser to turn these oft harried creatures over to a neurologist; it would often be well at least to seek his coöperation. The first step is the cessation of all marital attempts, and the next, and not without the best reasons, the adoption of an excellent, stereotyped but none the less valuable hygienic regimen of exercise, baths, massage, rest, food, and regulation of functions. It would be wiser in the extreme cases for the physician not to make any efforts to overcome the trouble by examinations or by trying out promising mechanical devices except under general anesthesia. A thorough dilatation of the orifice well beyond the maximum of the requirements of the situation will be a first step; Sim's vaginal plug like a large cylindrical dilator, worn for two or three hours daily, recumbent, will sometimes aid. A dose of paregoric and lubrication may facilitate the ingress and begin to establish a habit. Most surgeons favor in this intractable group a rather deep longitudinal incision about 3 centimeters long through the fourchet and up into the vaginal vault. The extreme ends are then sewed together and the sides approximated.

vert the wound into a transverse one at the orifice, Figure 170. The vast majority are likely to remain intractable unless conception supervenes, when, following labor, there is surcease of suffering.

A small rigid introitus often placed well anteriorly is an obstacle usually overcome by nature's dilator in the course of time.

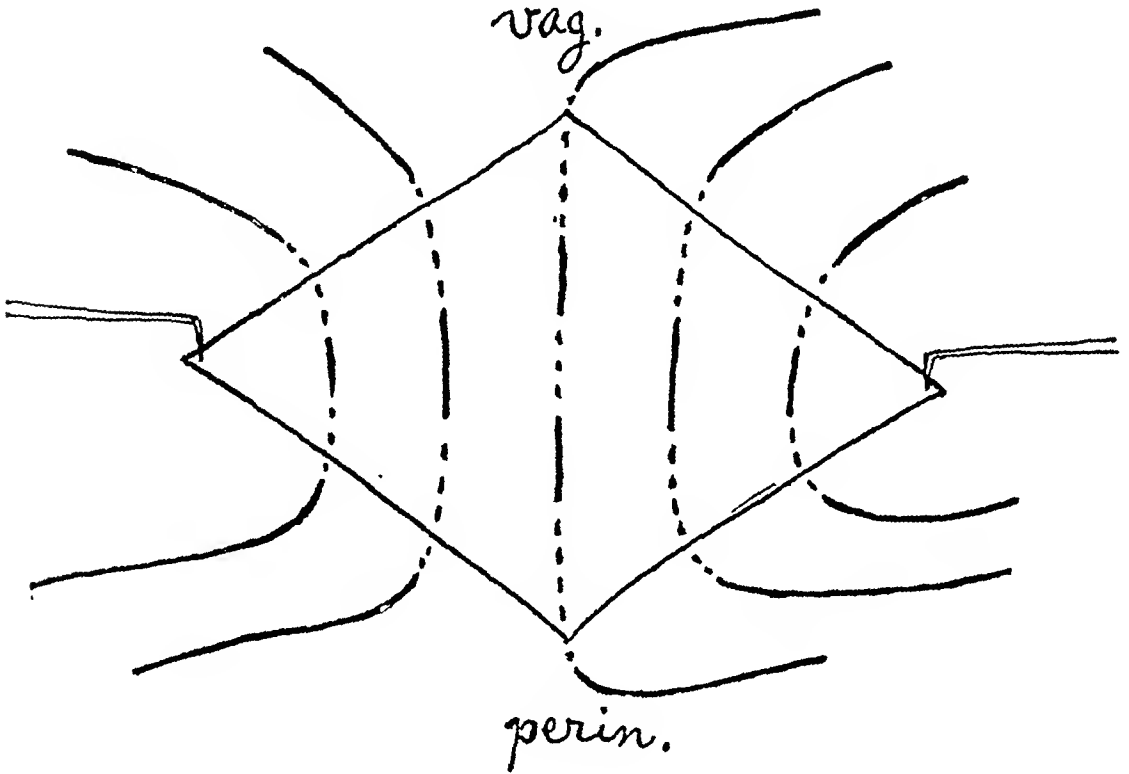


FIG. 170.—DYSpareunia.

Longitudinal incision at fourchet extending up into vagina drawn apart from side to side and sewed to enlarge vaginal orifice.

Maldevelopment of minor degree is not hopeless as the following case shows (Child, *Sterility and Conception*):

S.M., age twenty-six, married three years. Scarlatina at six, measles twice, at twelve and sixteen. Herself premature; weight at birth $1\frac{1}{4}$ pounds. Menstruated at thirteen, severe dysmenorrhea, and two attacks of menstrual mania. Examination: undeveloped genitalia, pubic hair deficient, vagina contracted and short, cervix and fundus infantile. Length of cervico-uterine canal 5 centimeters. Conception the following year; normal delivery of a living child at term. Two children later, and no more menstrual troubles.

Vaginitis calls for the usual treatment (Chapter XIII).

When the peccant cause is in a pelvic ureter under or lateral to the bladder, the treatment lies in the necessary dilatations of the strictured lumen of the duct (Chapter XLI), which relieves all pain and restores the local and often the general health. These are the ovarian neuralgias so common of old, which completely disappear under such purposive, direct, and discriminative treatments (*fide* G. L. Hunner).

Treatment, if operative, is usually best done under complete anesthesia; a large genital or clitoral lipoma, a Bartholinitis, or a tumor of the vagina should be excised. A stent ruptured hymen may be cured by a single quick incision from crescentic border to base. An ulcer at the fourchet or a painful scar should be treated by excision and closure with a fine catgut continuous suture; I would treat some ulcers by novocain injections in the periphery and coagulation of the entire area. The tender inflamed caruncles and the painful *taches* surrounding the orifice are best excised; the hope is greater when the cause lies more obviously in the caruncles.

A granuloma of the urethra and a caruncle are best treated, I think, by desiccation or coagulation of the base, avoiding Scylla and Charybdis by giving definitely more than a superficial treatment, when the disease is sure to recur, at the same time not going deep enough to form a scar likely to deform the orifice.

A suburethral abscess involving Skene's gland must be probed at its orifice and then incised with the ansector, laid wide open, cleaned out, and the lining membrane destroyed by coagulation. This is quicker and more thorough than dissection.

CHAPTER XVI

DISEASES OF THE CERVIX

GEORGE H. GARDNER

CONGENITAL MALFORMATIONS

CHILDBIRTH INJURIES

INFLAMMATORY CHANGES

Gonorrhea

Traumatic Cervicitis

Granuloma

Condyloma acuminatum

Syphilis

Tuberculosis

TUMORS

Polyp

Carcinoma

Sarcoma

Many alterations in our conception of the cervix and its diseases have found expression in recent years. Its importance as a prime factor in leukorrhea and in sterility has been elucidated; the significance of its inflammatory and structural changes as predisposing to cancer of the cervix is being appreciated more and more; and the successful treatment of cervical conditions has proceeded *pari passu* with the increasing knowledge of its pathology.

Histologically the cervix is covered and lined by epithelium with an intervening stroma of smooth muscle, connective tissue, and elastic fibers. The canal is lined by a single layer of high, narrow, columnar epithelial cells with nucleus at the base—"picket-fence" epithelium—set directly on the fibromuscular stroma with numerous thrusts into the stroma in the form of racemose glands secreting an alkaline mucus. Cellular stroma about the glands seen in the endometrium is lacking. The cervical canal terminates abruptly at the internal os, and the lining epithelium precipitously changes to endometrium. At the external os, the transition is equally abrupt into squamous epithelium covering the vaginal portion of the cervix. This squamous or pavement epithelium, like the vaginal mucosa, has no hornified layer, sweat, or sebaceous glands, nor hair-follicles.

Congenital Malformations.—The uterus, body and cervix, results in embryonic life from the fusion of the müllerian ducts. Failure to fuse or inadequate fusion results in several anomalies in which not only uterus and cervix



FIG. 171.—SO-CALLED "EROSION" OF CERVIX UTERI.
No laceration: infection of cervical glands has caused mucosa to swell and roll out into
vagina, partially everting cervix. Age 20.

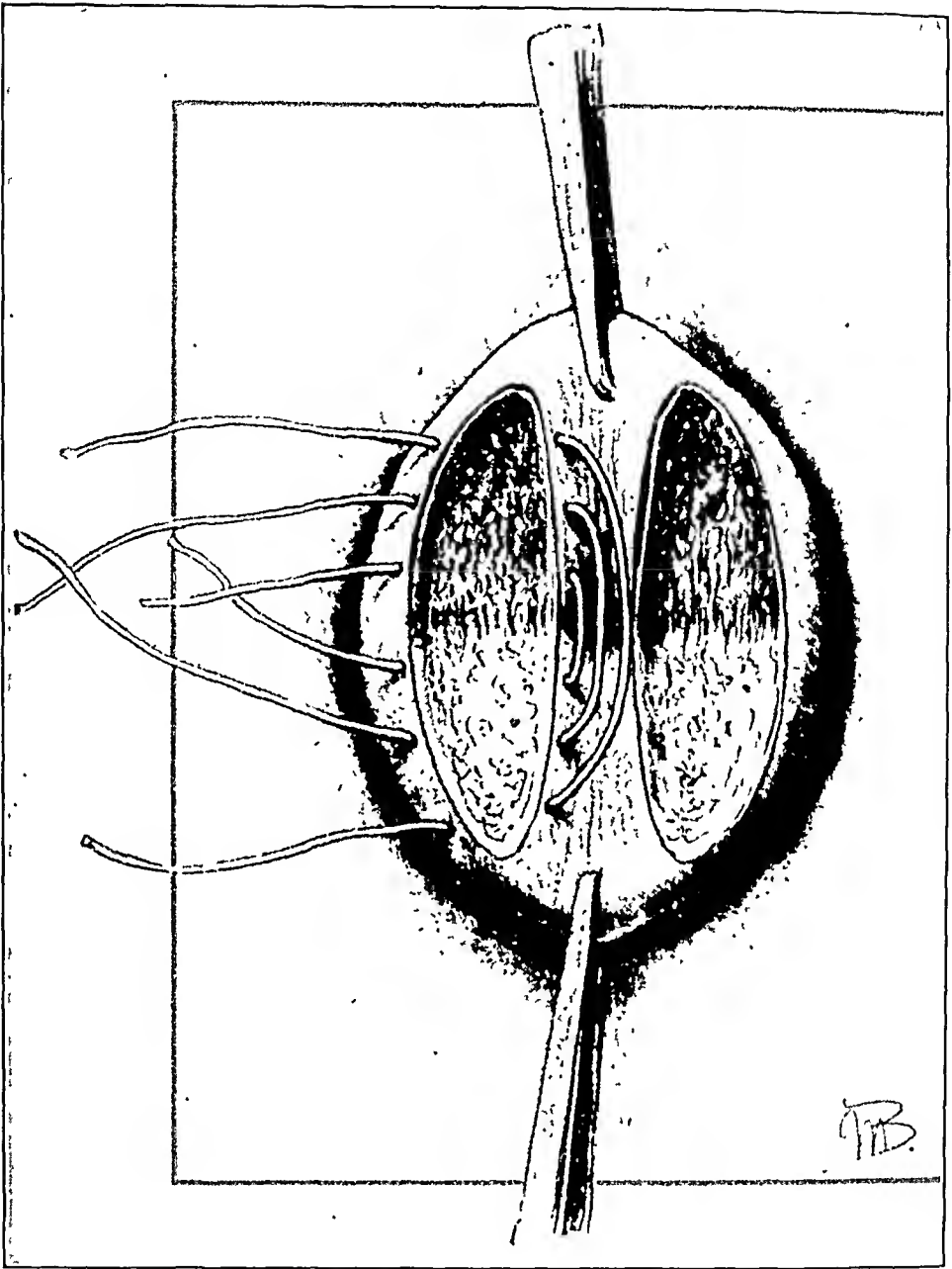


FIG. 172.—DENUDATION OF BOTH LIPS FOR PLASTIC UNION. SUTURES LAID IN PLACE ON RIGHT SIDE BUT NOT TIED.

but vagina may be involved and is thus associated with: (1) Uterus didelphys, double uterus, cervix, and vagina (rare); (2) bicornuate uterus with double vagina, the cervixes being fused; (3) bicornuate uterus with but one vagina; (4) a broad cervix with two orifices but one uterine cavity.

The commonest congenital malformation is a double canal. It must be mentioned that atresia and stricture of the cervical canal sometimes considered anomalies are due to scarring and fibrosis following birth. An apparent stenosis may result from uterine displacements.

Childbirth Injuries.—Some physiological rupture practically always takes

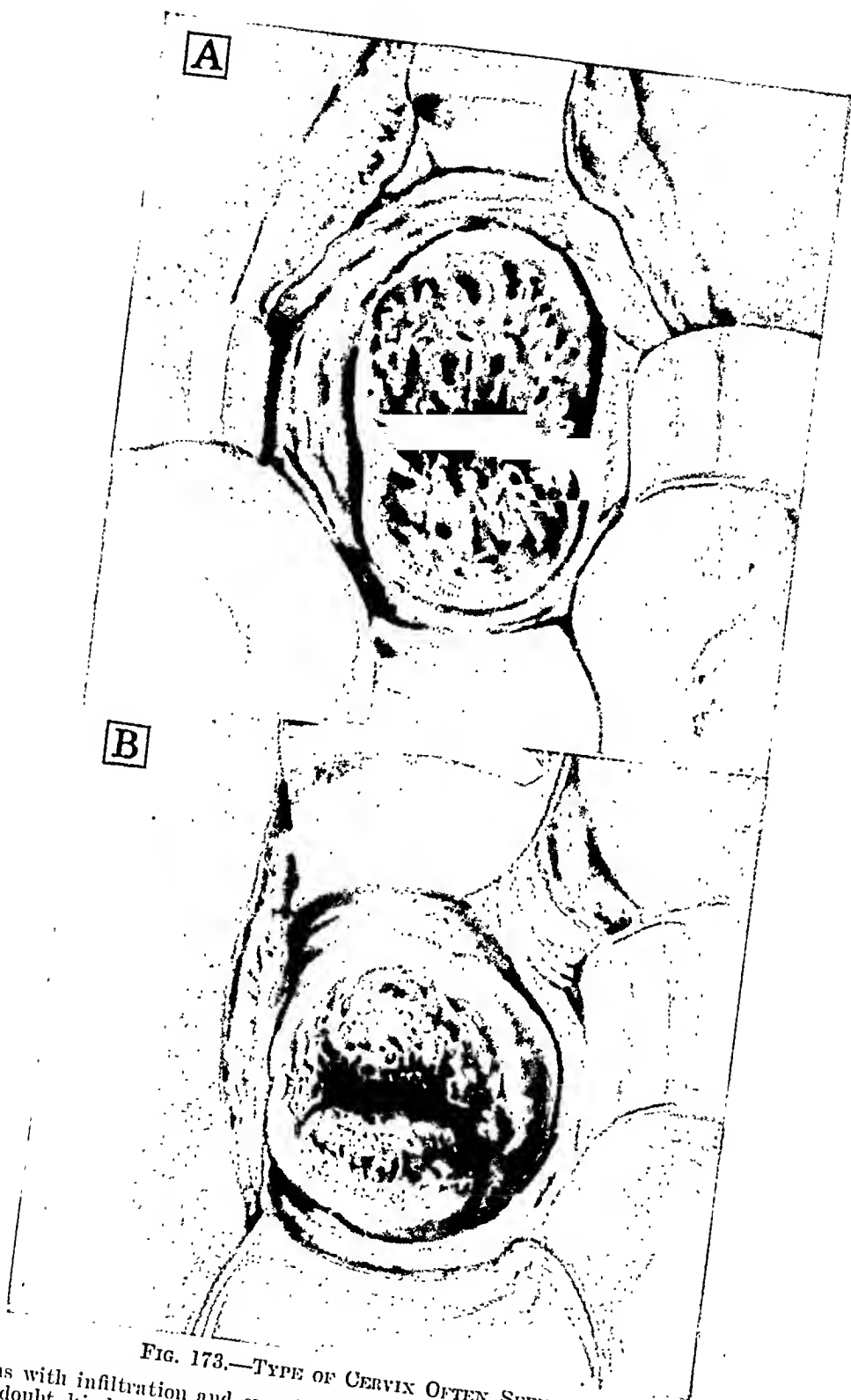


FIG. 173.—TYPE OF CERVIX OFTEN SEEN.

Lacerations with infiltration and eversion of cervical mucosa in three months postpartum. Without any doubt, kind of cervix frequently ending in cancer from long-continued irritation. Best treatment here is immediate suture postpartum or, later on, destruction of diseased mucosa with actual cautery. (G. G. Ward.)

FIG. 174.—BILATERAL LACERATED CERVIX WITH EVERSION AND EXPOSURE OF CERVICAL MUCOSA, ALSO FERTILE FIELD FOR SUBSEQUENT CANCER.

Treatment either immediate suture and closure, restoring parts to their integrity, or depletion, douches, etc., reducing cervix to normal, followed by denudation and suture (Emmet operation) or by destruction of mucosa with cautery. (L. K. P. Farrar.)

place in childbirth, remaining the sign manual of the antecedent event. Severe cervical tears are the common hallmarks of a naturally difficult labor or of a poorly executed obstetrical operative procedure, such as manual cervical dilatation, too early application and vigorous use of the forceps, version and extraction especially in an elderly primipara.

Of all diseases of the cervix, the two here described, standing in close causal relationship, are overwhelmingly the most important; namely, the lacerations of childbirth and the low grade of chronic inflammation following this injury.

Some degree of laceration is unavoidable, but a deep laceration such as so often occurs in a forceps delivery is as profoundly pathological as a rupture of the vaginal introitus even into the rectum. Such an injury is exceedingly liable to a low-grade persistent inflammation, invading the glands and the submucous cervical connective tissues and causing swelling, and as it invades the glands higher up, the mucosa becomes everted (ectropion) and the lips are spread widely apart and greatly increased in size. In the lesser grades the bilateral tear, flattened out by the attrition on the posterior wall, may impose upon the observer as a simple eversion of the mucosa, or a natural invasion of the vaginal portion by intracervical mucosa—an opinion fortified by the microscopic examination—or an “erosion” as it was called of old, or even as an “ulcer of the womb,” a designation still common in localities.

The characteristic symptoms are a sense of bearing down or weight, often associated with subinvolution and a broken down outlet favoring descensus, a copious mucous or mucopurulent secretion (frequently called catarrh), and sometimes moderate bleeding. The condition with its evil sequelæ becomes the more striking when compared with the occasional deep tear seen where there has been no infection and eversion with the outpouring of the secretions.

The diagnosis is easily made by touch alone, noting the enlarged altered cervix, its thickness, and the slippery, sometimes hard or again softened surface. Inspection confirms this and adds the striking characteristic appearance.

One of the most important questions of the day connected with the whole cancer situation is whether or not such a common neglected chronic inflammation is the most easily recognized and potent of all sources of cancer. The occurrence of cancer on such cervixes is a matter of such common observation that for thirty years I have been convinced that this lesion is its one great common cause, and this conviction is gaining ground with the entire profession.

A point to be settled is whether the disease is more apt to start in one angle of the tear, as would seem to be indicated by its common unilateral origin, and spread out into the broad ligament, or whether it involves first an area of the exposed mucosa. In the latter event, does it begin in a small area, as sometimes seen, or usually spring up as a general tendency involving one lip?

Without doubt all these modes of origin are observable, but which is the commonest?

If we admit, pending more extensive and convincing observations, that for



FIG. 175.—CHRONIC ENDOCERVICITIS.

Mild inflammatory process in vaginal portion of cervix. Well-formed cervical gland surrounded by some round-cell infiltration. At mouth of gland are two small nabothian follicle cysts. $\times 50$.

our present purposes we have here our commonest recognizable source of cancer in the body, the practical significance is enormous, entailing immediate obligations to adopt routine plans of treatment hitherto overlooked or at best only casually resorted to. Treatment is either prophylactic or corrective.

Prophylaxis involves the immediate suture of every laceration which presents deeply torn gaping ragged cervical lips, and this calls for a postpartum thorough exposure of the cervix under conditions easily realized in a hospital and with greater difficulty in a private home, followed by a suture approxi-

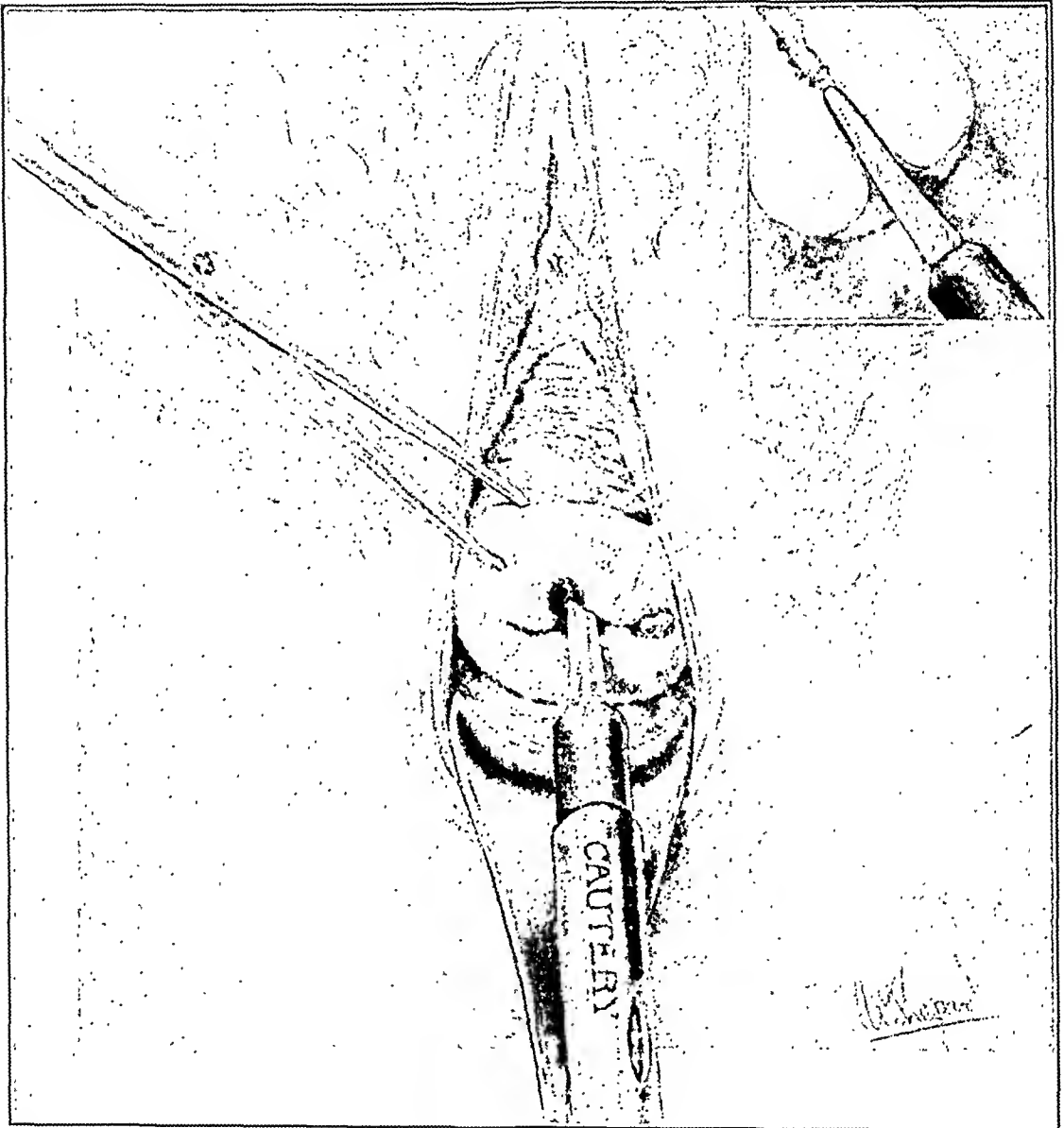


FIG. 176.—CAUTERIZATION OF CERVIX.

A simple office procedure which is effective in vast majority of cases. (G. L. Hunner.)

imating the anterior and posterior lips and making so far as possible a *restitutio ad integrum*.

J. B. De Lee, who has followed this plan consistently for twenty years, while finding the immediate operation on the whole not so satisfactory as the repair of the perineum, has never observed a subsequent cancer. 71

Lilian K. P. Farrar, in coöperation with George Gray Ward, believes in an immediate repair in approximately one-third of all deliveries, not difficult in an operating room, further remarking that such a repair certainly means a

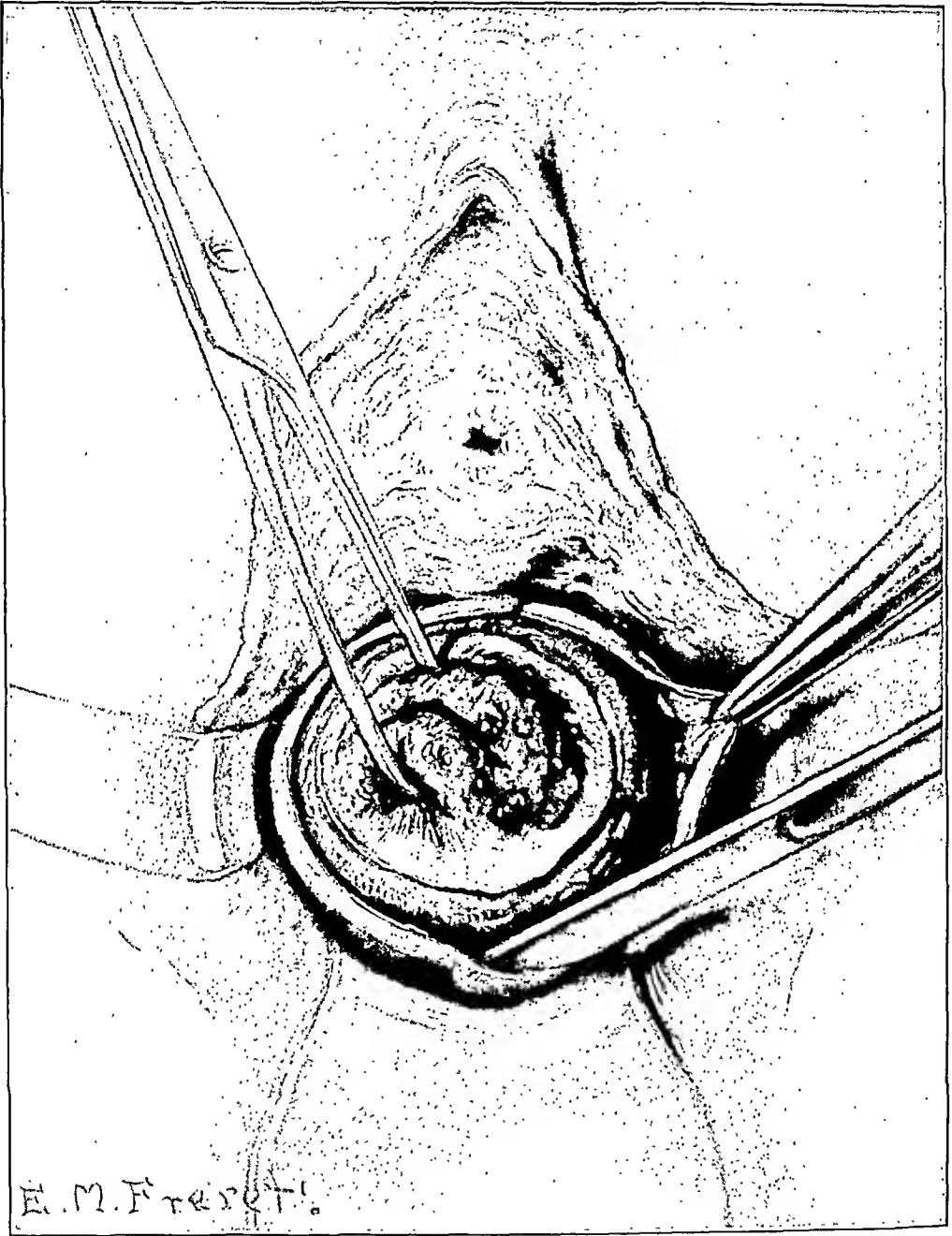


FIG. 177.—SEPARATING MUCOUS MEMBRANE, ALONG LINE OF CLEAVAGE; NO BLEEDING.

Sufficient flap must be separated to cover completely the denuded "cone" area. (H. B. Matthews.)

better involution of the uterus with no subsequent eversion of the lips with erosion and cystic degeneration.

The two illustrations, Figures 173 and 174, in color, presenting lacerated cervixes three and three and a half months postpartum, are a perfect picture

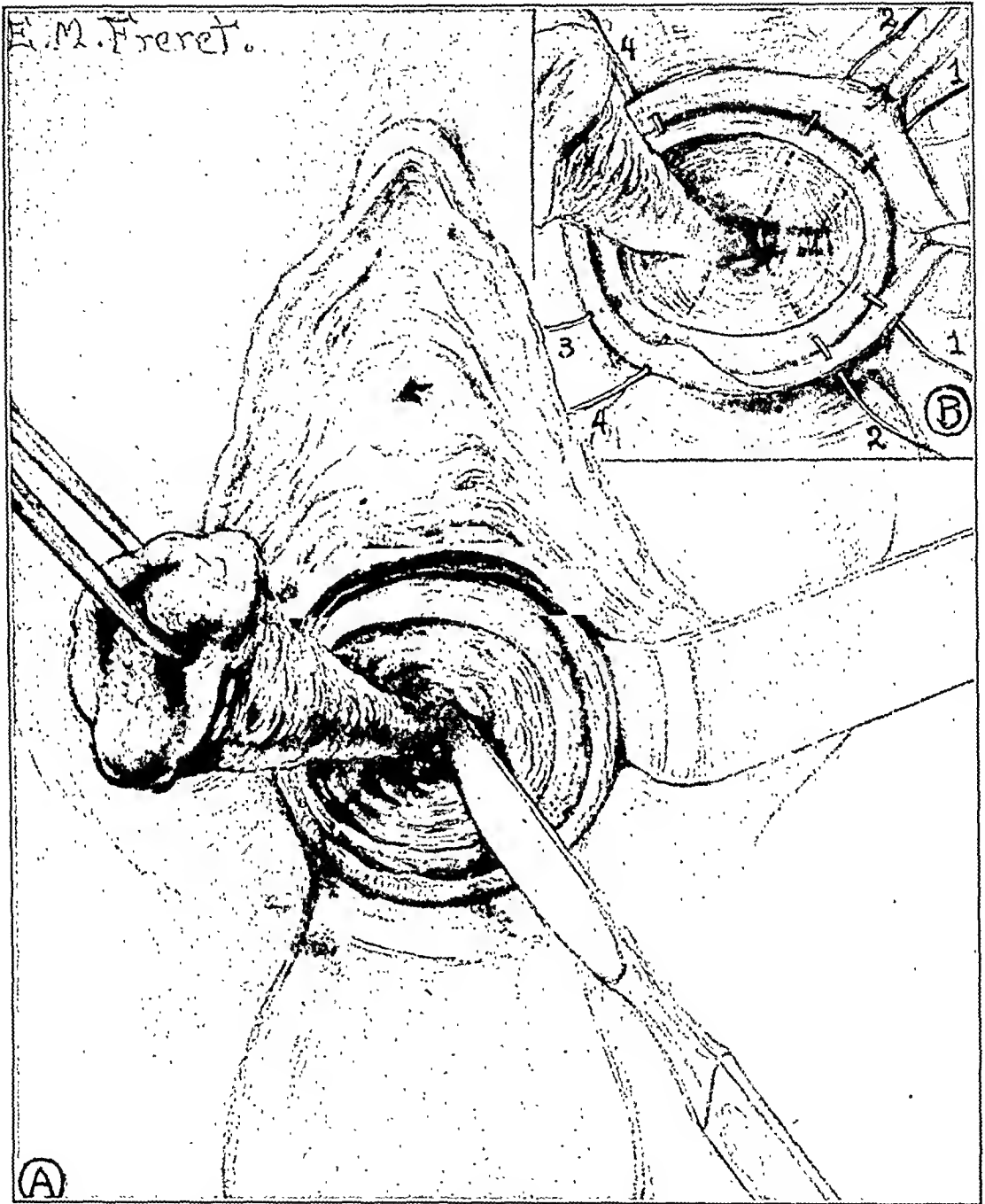


FIG. 178.—A. "CONE EXCISION" OF INFECTED AREA COMPLETED BUT CERVICAL CANAL NOT OPENED; CONE USED AS TRACTOR TO FACILITATE PLACING OF SUTURES AS SHOWN IN B.

B. SUTURE 1 BEGINS AT 2:30, EMERGES AT 3:30; SUTURE 2 BEGINS AT 1:30, EMERGES AT 4:30. SUTURE 2 SHOULD NOT ENTER, BUT MUST APPROACH THE CERVICAL CANAL. (H. B. Matthews.)

of conditions too often seen—the seat of a rapidly advancing cancer—and must carry their own conviction as to the propriety of immediate repair.

Chronic cervicitis grafted on a tear can be dealt with as Emmet and his followers used to treat it, by taking some weeks to deplete and open all cysts, with rest in bed and hot douches and boroglycerid or medicated hygroscopic

packs, followed finally, when the cervix is soft and free from infiltration and the lips are readily brought together, by Emmet's operation of a wedge-shaped denudation and union by suture. An objection to this course is the habitual

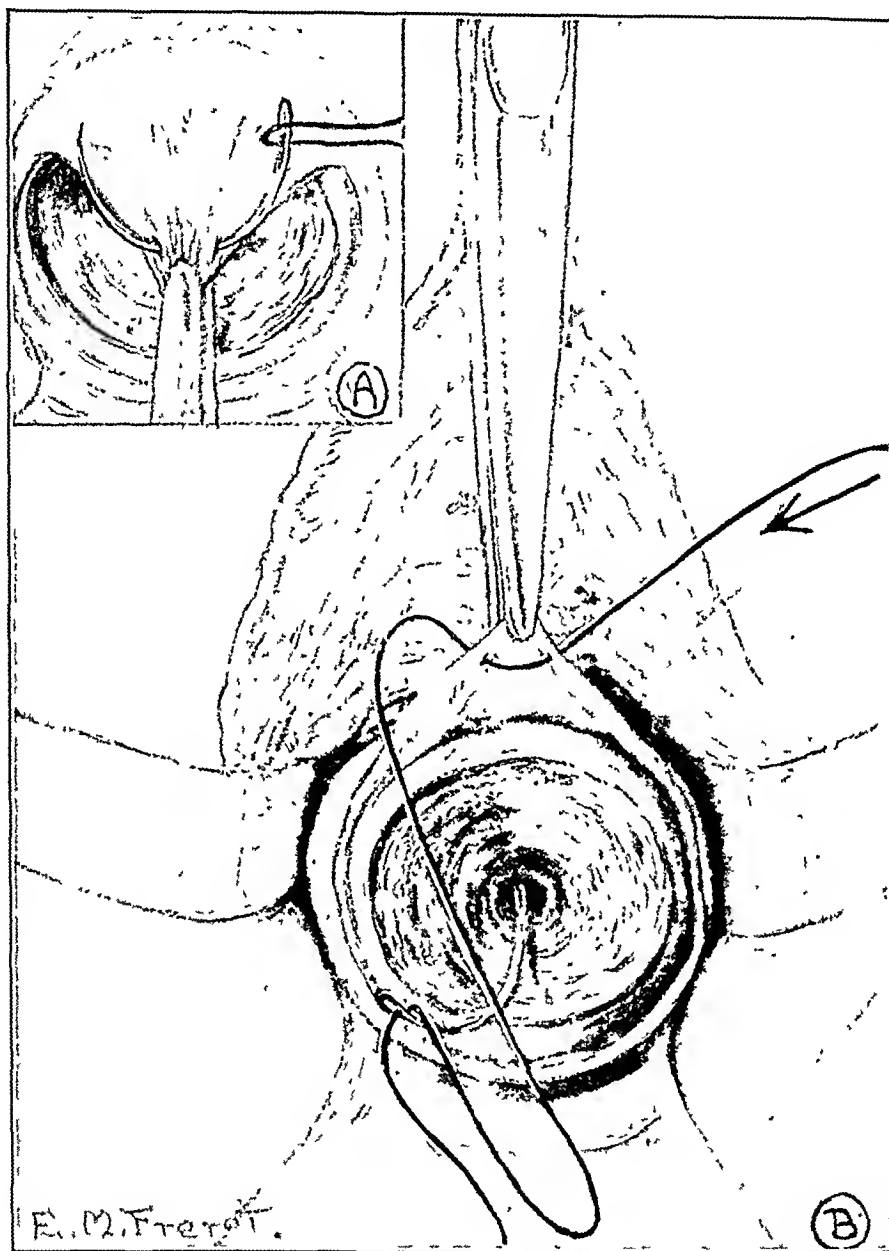


FIG. 179.—A. ESTIMATING EXTENT OF FLAP NEEDED AND METHOD OF PLACING FIRST STITCH OF THE DOUBLE INVERTING STITCH AS SUGGESTED BY STURMDORF.

B. TECHNIQUE OF PLACING FIRST HALF OF DOUBLE INVERTING STITCH; NEEDLE WELL UP THE CERVICAL CANAL; GOOD BITE OF CERVICAL TISSUE. (H. B. Matthews.)

unwillingness of both patient and doctor to carry out the thorough preparatory course essential to success.

The better as well as the speedier plan is the cauterization of the chronically inflamed and everted cervix by the actual cautery (G. L. Hunner). This can be done in one of two ways, either by longitudinal rather deep cauterizations done

on the office table—two or three rather deep strokes on each lip, repeated every four to six weeks until the whole is healed and the cervix shrinks into a normal appearance—or by burning out thoroughly the whole diseased area at one sitting, usually under gas anesthesia. If this is done more on the exposed

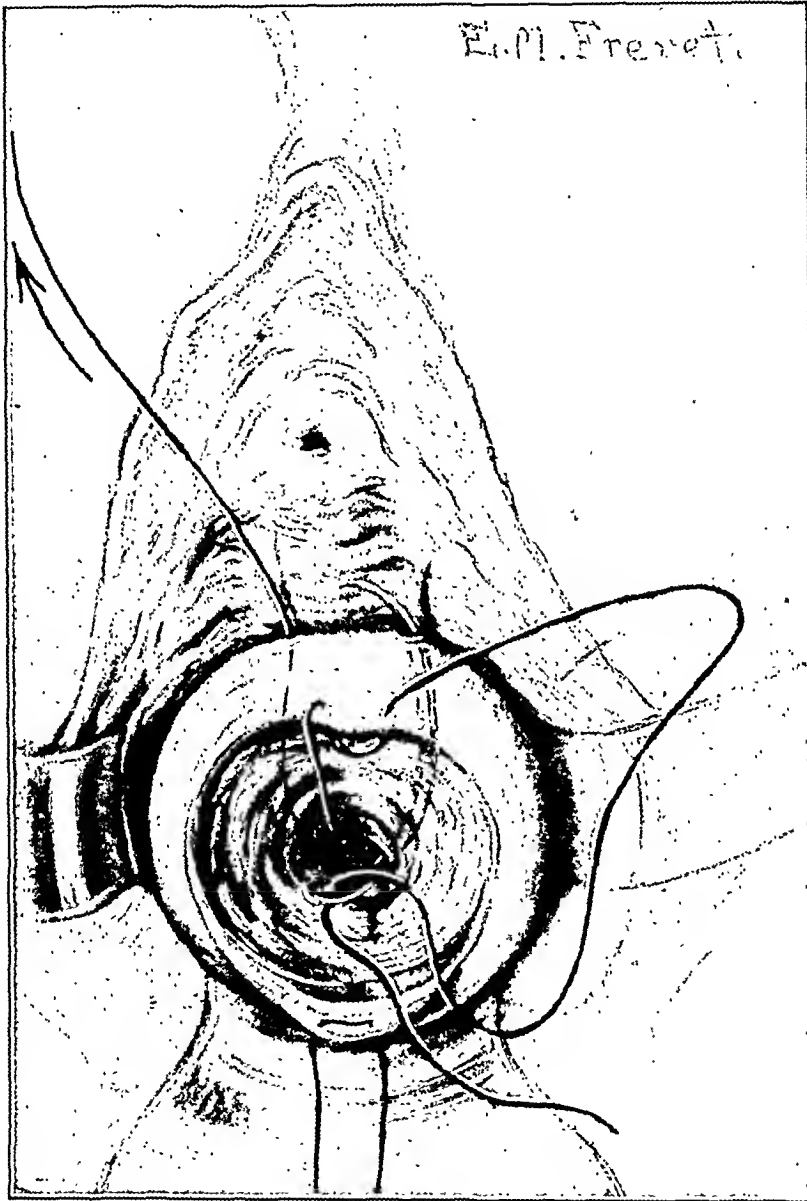


FIG. 180.—SECOND HALF OF DOUBLE INVERTING STITCH.

Most important to have sufficient mucous membrane to cover all denuded area. (H. B. Matthews.)

area, the tendency to any ascending trouble will be less. It takes about six weeks for complete recovery after a day or two abed.

The treatment of hypertrophied elongated cervix is amputation, the extent depending upon the question of future pregnancy. After the menopause a guillotine amputation may be performed, but it is always likely to be attended

GYNECOLOGY

by postoperative hemorrhage. The modification of Sturmdorf's procedure,¹ recently reported by TeLinde (*Surg., Gynec., & Obst.*, 1926, 43) is advisable; this is rarely followed by postoperative hemorrhage or cervical dystocia.

The interrelation of weakened uterine supports, lacerated perineum, and hypertrophied elongated cervix must be recognized both etiologically and symp-

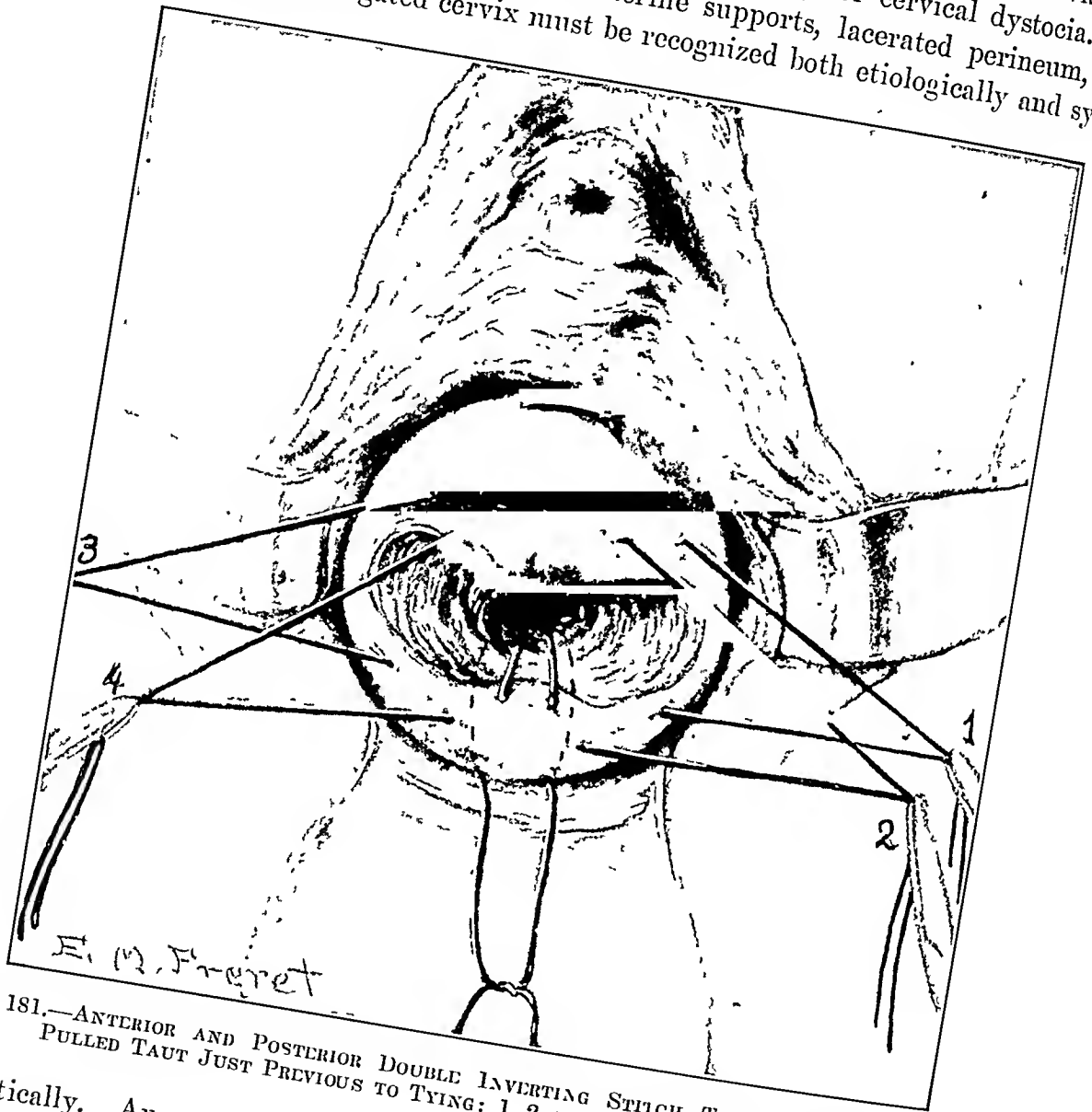


FIG. 181.—ANTERIOR AND POSTERIOR DOUBLE INVERTING STITCH TIED; LATERAL SUTURES PULLED TAUT JUST PREVIOUS TO TYING: 1, 2 AND 3, 4. (H. B. Matthews.)

tomatically. An operation which does not take all three of these factors into consideration cannot be considered either advisable or adequate and will not lead to a cure.

Inflammatory Changes.—An inflammation of the endocervix, endocervicitis, commonly and without warrant called cervicitis, occurs when the endometrium is rolled out and infected in a lacerated cervix. Such an eversion

¹ We are indebted to H. B. Matthews for Figures 177, 178, 179, 180, 181, and 182, from the department of obstetrics and gynecology, Long Island College Hospital. Matthews has published a noteworthy contribution on the "Comparative Value of Electric Cautery and Sturmdorf Operation, in the Treatment of Chronic Endocervicitis," *J. Am. M. Ass.*, 1926, 87.

also occurs when a nulliparous cervix becomes inflamed, as the only direction in which the swollen mucosa can expand.

The common cause is the nesting of the gonococcus in the cervical glands where it lingers with the utmost tenacity; it also arises from the nonspecific infections of childbirth.

The outstanding and characteristic symptom of a cervical inflammation is a leukorrheal discharge—glairy, mucoid or yellow mucopurulent, tenacious,

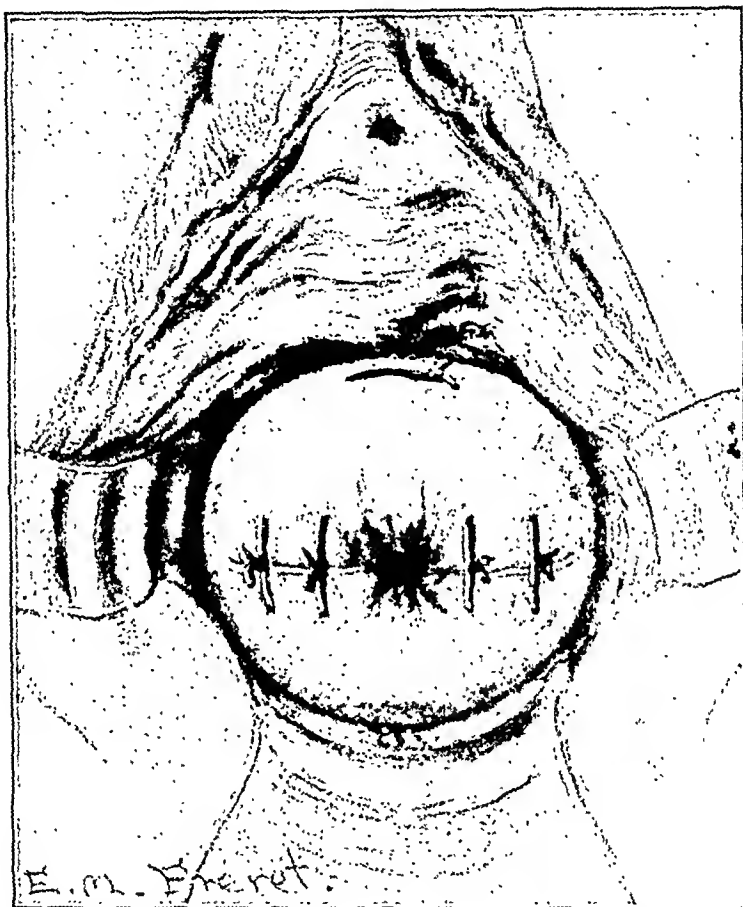


FIG. 132.—ALL SUTURES TIED; OPERATION COMPLETED; ONLY SIX SUTURES.
(H. B. Matthews.)

and ropy, occasionally with some blood-staining; in the tuberculous cervix, blood is an outstanding feature.

In contrast with endocervicitis, endometritis is rare.

By touch one often feels a soft, slippery, eushiony condition which, coupled with a laceration, is characteristic. Inspection, best in the knee-chest posture, is at once revelatory—laceration and mucus or mucopus in the canal and, covering the highly reddened, swollen, everted mucosa, the so-called ulcers of our forefathers, here and there, clear or yellow, scattered over the surface.

It is a wise working hypothesis that all cases of endocervicitis are gonorrheal until proven otherwise. Smears taken directly from the surface and

GYNECOLOGY

from the endocervix should be examined for gonococci. Diagnosis is made by demonstrating Gram-negative intracellular diplococci in the secretions.

Any questionable ulcers demand a dark-field examination for treponema. Suspicious lesions should be examined under the microscope.

Whether specific or nonspecific, the treatment is the same.



FIG. 183.—ENDOCERVIX.

Lining mucosa replaced by vascular granulation tissue infiltrated by wandering cells. Several larger glands surrounded by cellular infiltration, extending through muscle-bundles. $\times 75$.

Recently Brady (*Johns Hopkins Hosp. Bull.*, 1925, 37) has reported excellent results from the use of mercurochrome in *gonorrhea*. The patients are given daily hot vaginal douches. Biweekly, under sight, the cervical canal, as high as the internal os, is thoroughly treated with 20 per cent mercurochrome on a cotton swabbed metal applicator. Before the medicament is introduced, all secretions are wiped out of the cervical canal. All treatments are suspended during the menses and no douches are given on the days smears are to be taken. Results are determined by smears controlling the presence of gonococci and also

by the amount of leukorrheal discharge. Criteria for cure are four successive negative smears for gonococci, taken three at two-week intervals and the fourth a month after the third negative, and a reduction of the discharge to that which is considered normal before the menses. Corbus uses diathermy applied in a special small tube like a cystoscope, carrying a thermometer, at an elevated



FIG. 184.—ENDOCERVIX.

Periglandular and diffuse round-cell infiltration more advanced. Lining epithelium partially intact, replaced by granulation tissue. $\times 75$.

temperature (Chapter XLVIII). This kills the gonococcus which is much more sensitive than the normal cells.

Traumatic cervicitis may follow long-continued wearing of a pessary under unhygienic conditions, lay or amateurish attempts at abortion, operative procedures on the cervix, procidentia, and the use of too concentrated antiseptics as vaginal douches.

It is first treated by removing the cause, whether it be prolapse, pessary, or ill-advised douches. If local treatments are not adequate, operation may

be necessary, and here again TeLinde's modification of the Sturmdorf principle is quite useful.

Granuloma of a nonspecific variety is rarely encountered on the cervix. It may be found as an ulcer or as a proliferating granulomatous mass. Customarily associated with gonorrheal infection, there is no evidence that the gonococcus is the etiological agent. It seems more likely that it should be



FIG. 185.—VAGINAL PORTION OF CERVIX.

Several nabothian follicle cysts, all but two empty; lining membrane detached. Cervix here covered by stratified squamous epithelium; note proximity of cysts of surface. $\times 16$.

classified with *granuloma inguinale*. Granuloma may respond to intravenous tartar emetic, or one may have to resort to local destruction with the cautery or resection. Operations, unless quite extensive, are likely to be followed by recurrence and should be attempted only by the experienced operator.

Condyloma acuminatum or venereal wart, rarely found except on the vulva, occasionally extends into the vagina and even to the cervix. The warts are considered by many to be of gonococcal origin. Histologically, they are benign, with great overgrowth and piling up of squamous epithelium which has no tendency to break through the basement-membrane. There is no tendency

to invasion or metastasis and no changes in the individual epithelial cells suggestive of malignant degeneration. Venereal warts are not true tumors but infectious granulomata, consequently we have grouped them under cervical inflammations.

They are best eradicated by the high frequency current; some prefer local

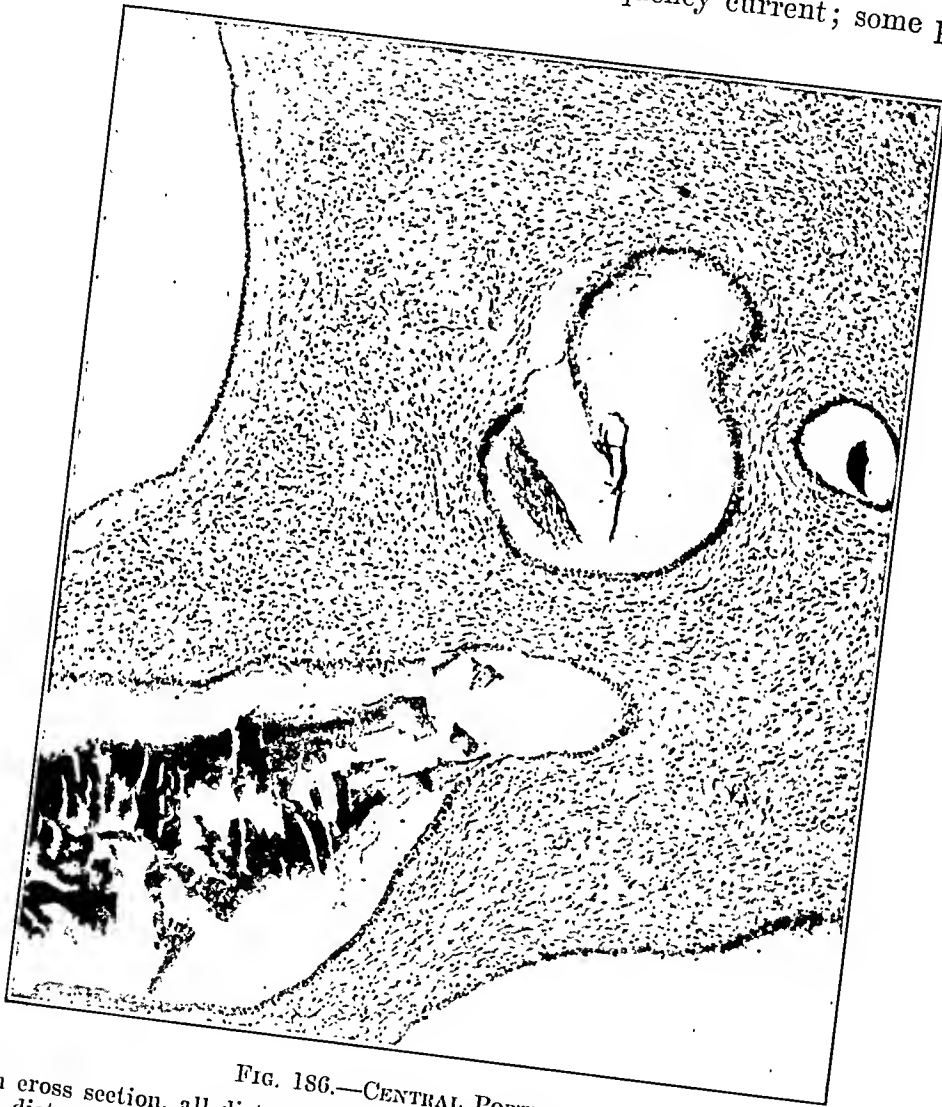


FIG. 186.—CENTRAL PORTION.

Glands in cross section, all distended; height of lining epithelial cells decreases as glands become more distended. Little evidence of inflammation; occasional wandering cell. $\times 75$.

destruction with concentrated nitric acid. General hygiene in both granulomata and warts is essential; they are usually found in filth.

Syphilis occurs either in the vaginal or endocervical portions as a chancre, a mucous patch, or a gumma (*Am. J. Obst.*, 1916, 73). It is stated that 1.5 per cent of all primary luetic lesions occur on the cervix; the lesion occasionally no symptoms, heals quickly, and is only found after a careful search. A chancre has the characteristic appearance, but the positive identification depends upon the treponema as the Wassermann test is not available so early.

Secondary lesions are leukoplakic macules, typical papules, or yellow-colored ulcers where the treponema is found. Gummata have been noted often, occurring either as intact proliferating tumors or as necrotic, ulcerative lesions. The Wassermann reaction is of value in secondary and tertiary manifestations.

The several lesions respond promptly to the usual intravenous antiluetic therapy.

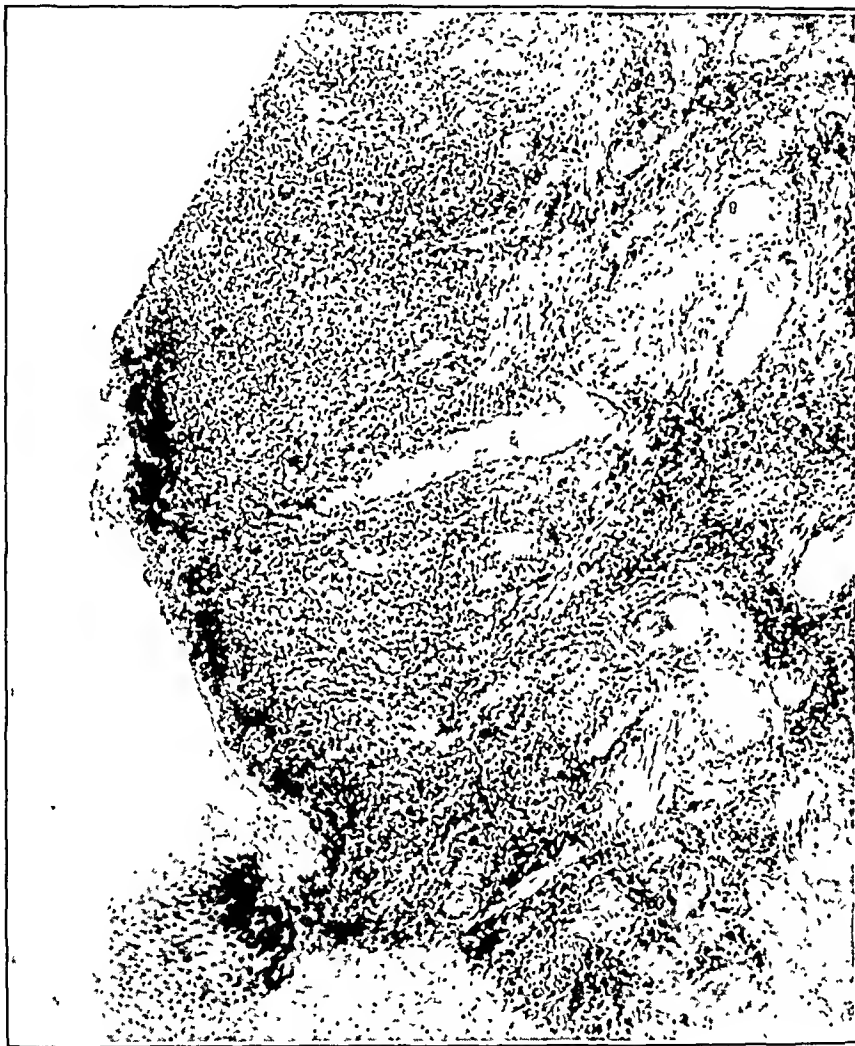


FIG. 187.—ULCER OR "EROSION" ON VAGINAL PORTION OF CERVIX.

Squamous epithelium entirely destroyed except small piece at lower pole of ulcer, filled with densely infiltrated granulation tissue not particularly vascular. Cervical glands absent. Large spaces are blood-vessels. $\times 75$.

Tuberculosis is rare; but few instances of the primary form have been described, resulting probably from genital importation. It is more commonly found as part of a generalized tuberculosis or part of a genital tuberculosis of a descending type from tubes or uterus.

The bacilli are found in the cervix incidental to a routine microscopic study (*Surg., Gynec., & Obst.*, March, 1916), or, again, a single large conglomerate tubercle may present itself as a cervical tumor. Wharton (*Surg.*,

Gynec., & Obst., August, 1921) describes a granulomatous tumor due to an extensive apparently superficial involvement of the cervix by tubercles and granulation tissue. In a similar case, the cervix was several times normal



FIG. 188.—TUBERCULOSIS OF CERVIX.

Many normal cervical glands scattered through stroma with tubercles and giant cells. Note extensive round-cell infiltration. In central portion the tubercles tend to form confluent mass. $\times 150$.

size and bled easily, while tissue was secured with difficulty as it was not friable.

The treatment is an abdominal panhysterectomy when the cervical involvement is part of a pangenital tuberculosis. The rule in a local manifestation of a generalized miliary tuberculosis is *noli me tangere*.



FIG. 189.—LONGITUDINAL SECTION OF EXTERNAL OS.

Vaginal and endocervical portions diffusely infiltrated by tubercles and tuberculous granulation tissue. Note piled-up tissue in endocervix. $\times 15$.

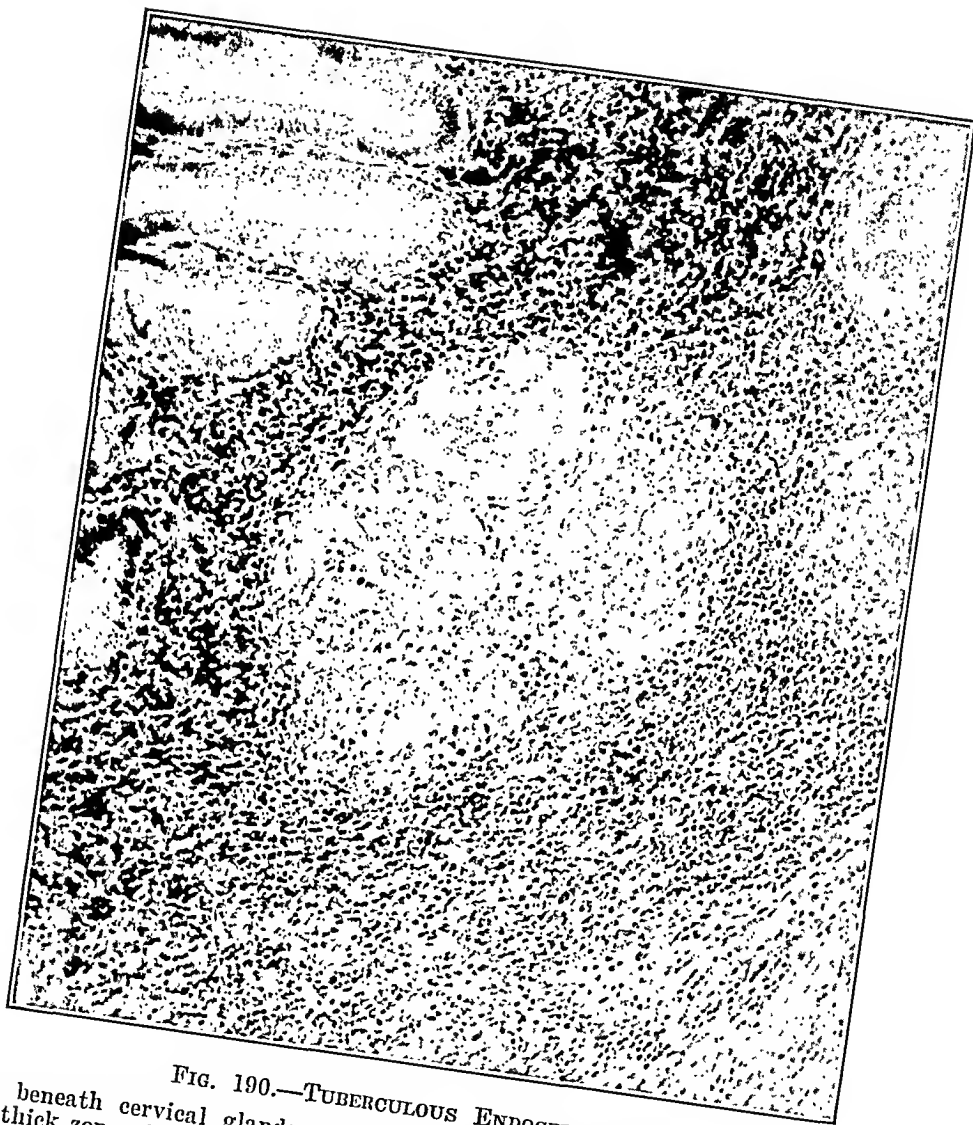


FIG. 190.—TUBERCULOUS ENDOCERVICITIS.

Tubercle beneath cervical glands. Giant-cells nested in epithelioid cells, in turn surrounded by thick zone of small lymphocytes. $\times 170$.

Tumors.—The commonest cervical tumor is the *polyp*—one or more small, soft, red tumors made up of mucous tissue, hanging in or out of the os, and varying in size from a little flabby tag of tissue to elongated fingers, even protruding at the vaginal orifice.

Microscopically they consist of high columnar epithelium with a loose fibrous stroma supporting the many blood-vessels and cervical glands. Trauma induces inflammation and round-cell infiltrations. Occasionally, a polyp is covered by squamous epithelium and originates in the vaginal portion.

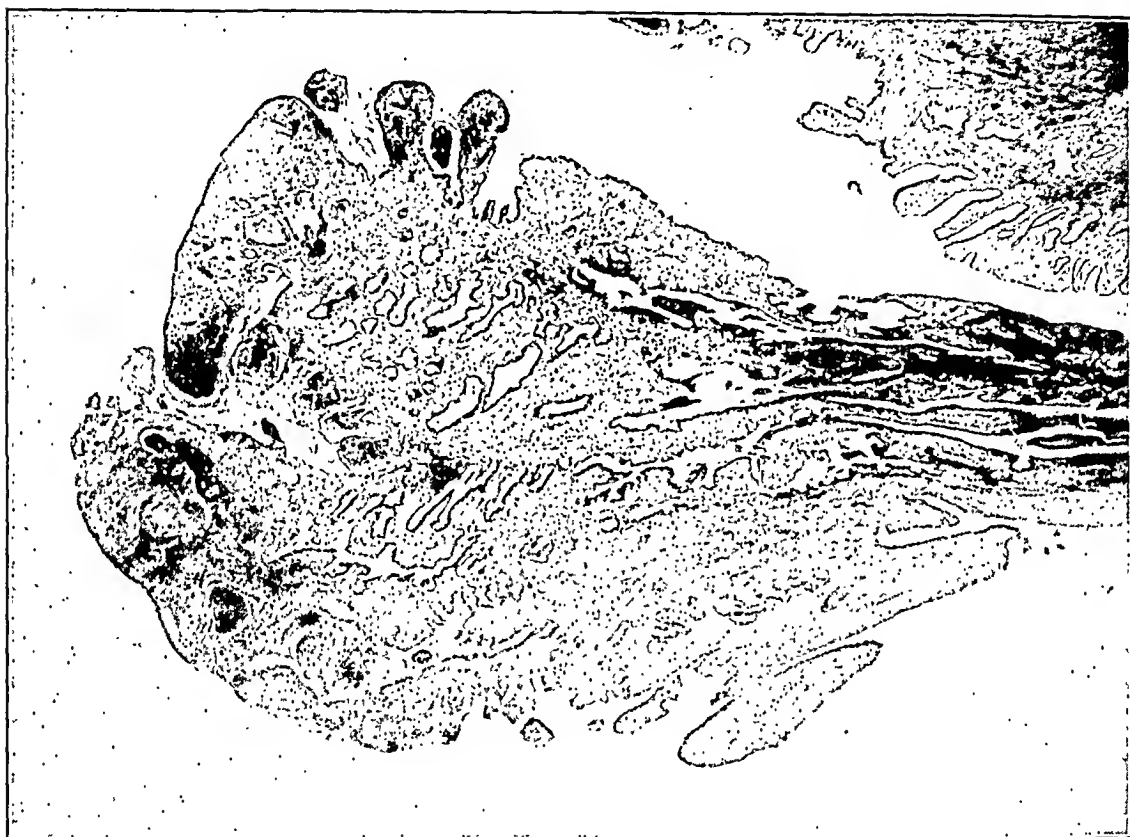


FIG. 191.—CERVICAL POLYP.

Margin of cervix (1); pedicle of polyp (2); composed of normal cervical glands and stroma. $\times 8$.

The common symptom to which polypi give rise is intermenstrual bleeding, a metrorrhagia with almost daily spotting; again, the menses are profuse and there is a leukorrhea.

The logical treatment is to grasp the small growth with a polyp or stone forceps and twist it off, watch it a little and pack if there is any bleeding. Ligation of the pedicle is the proper treatment of a larger growth when the base is accessible. Some prefer to split the anterior lip of the cervix in the midline up as far as the internal os, pushing up the bladder and securing a view of the entire canal and so assuring oneself that there are no tumors left.

Perhaps the best of all methods is to use the desiccation or coagulation

electric current to destroy the disease *in situ*. Wherever it can be seen, even up in the cervical canal, it can be obliterated with a fairly strong current and left to come away or pulled away piecemeal. Following this, aseptic conditions should be maintained, especially by applications of a mercurochrome alcohol acid solution.



FIG. 192.—ELONGATE FINGERLIKE CERVICAL POLYP.
Absence of superficial epithelium accidental. $\times 15$.

Recurrent cervical polypi should make one suspicious of sarcoma. Routine microscopic examination of all operative specimens is absolutely essential.

Carcinoma is dealt with in Chapter XXXI.

Sarcoma is rare, surprisingly so considering the abundant fibrous and elastic tissue which with smooth muscle goes to make up the bulk of the organ.

Several kinds of malignant connective-tissue tumors are reported; spindle-cell sarcoma, endothelioma, sarcoma arising in a myoma, and sarcoma botryoides. The spindle-cell sarcoma is of the same type as that in other organs, spindle-cells predominating and nuclear figures and chromatin variations being

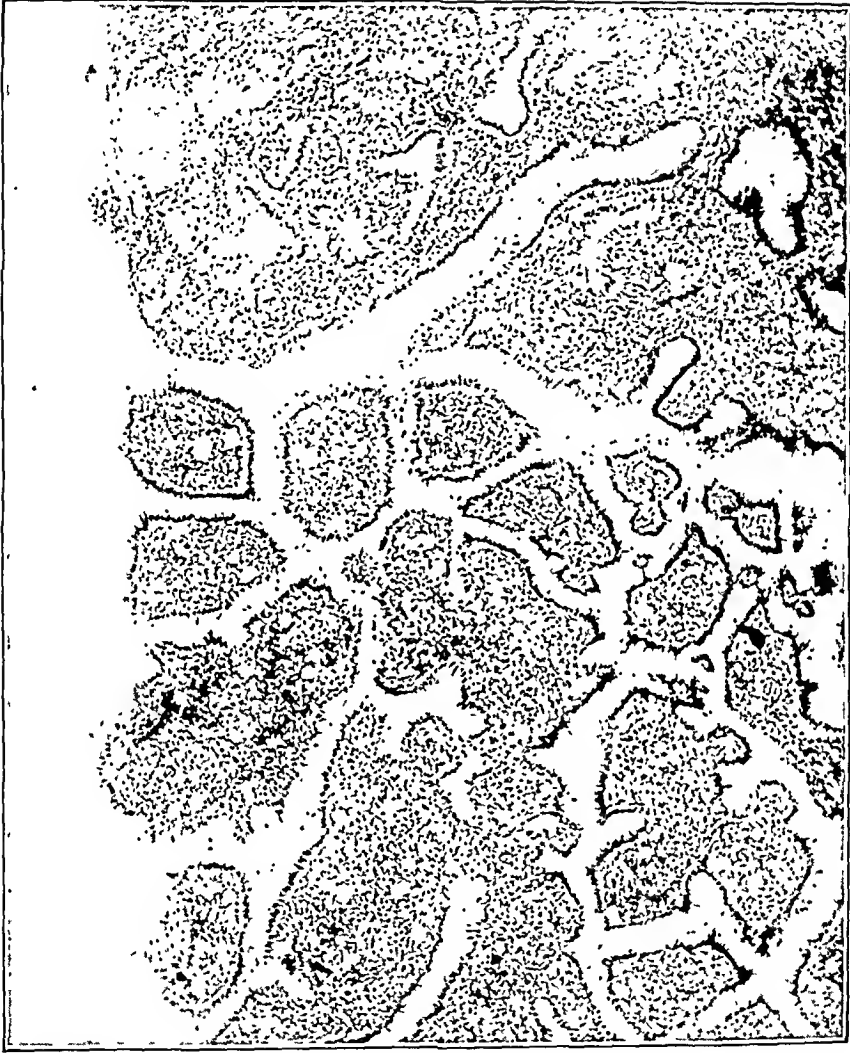


FIG. 193.—SURFACE OF CERVICAL POLYP.

Tendency to papillomatous form, each finger covered by characteristic picket-fence epithelium, stroma infiltrated. $\times 75$.

conspicuous. True endothelioma is extremely rare; here the sarcoma cells often are grouped about the tiny blood-vessels and appear to have originated there. It is possible that the endotheliomata so far described are rather apparent than real. Sarcoma botryoides is a loosely cellular polypoid tumor hanging from the cervix like a cluster of grapes, originating in the cervical stroma. In



FIG. 194.—CURETTINGS FROM CERVICAL ADENOCARCINOMA.

Considerable blood and fibrin imbedded in cervical stroma. Arborescent adenomatous structures characteristic. $\times 75$.

one instance we have seen the uterus also contain polypi in its lower portion. As the cervical mucosa has no cellular stroma like that of the endometrium, it seems likely that the tumor arises from an extended endometrial stroma. Instances of a simultaneous sarcoma and carcinoma in the cervix have been described, although the reports are not convincing (Ewing, *Neoplastic Diseases*, 2d edition, 1922).

The treatment of sarcoma is either radical extirpation in the early stages or radium in the more advanced and inoperable. It is also feasible to use radium, giving a thorough treatment, and then to operate at once.

Enlargement of the uterus sometimes follows a cervical operation or occurs in the course of a cervical disease and should ever be borne in mind. While this may be due to the extension of a growth, it is also frequently the result of a stenosis with the retention of secretions—blood (hematometra), pus (pyometra), or gas (physometra), or a combination of these. We are seeing

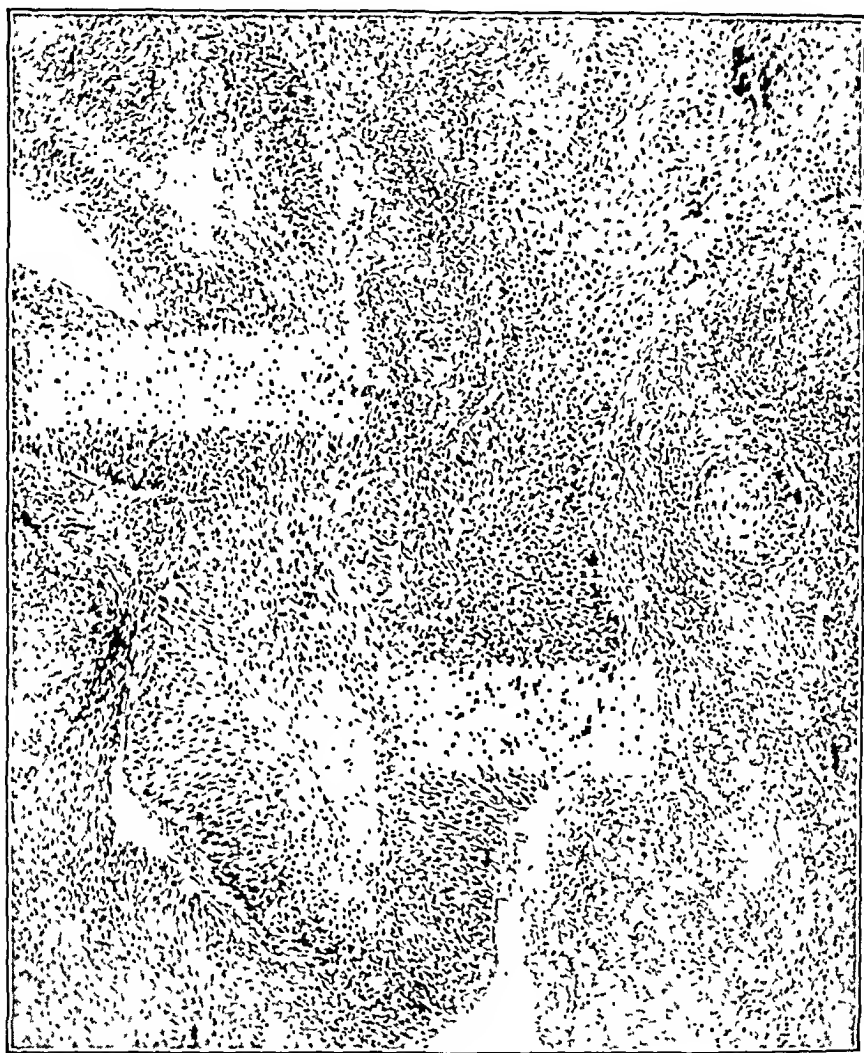


FIG. 195.—TISSUE REMOVED FOR DIAGNOSIS.

Wild growth of squamous epithelium with central areas of necrosis. Variation in size and intensity of staining in cancer cells. Note invasive character of growth. Typical squamous cell (epidermoid) carcinoma. $\times 75$.

more of these heretofore rare affections since the advent of radium in cervical carcinoma.

If a patient has lower median pain, she has not felt before, and some rise in temperature, it is often well to pass an instrument, say a curved artery forceps, up into the uterus and open it, watching to see whether there is any discharge. A physometra is sometimes explosive in its escape. If there is retention, it must be given a free exit and watched from time to time.

CHAPTER XVII

LACERATIONS OF THE PERINEUM

HOWARD A. KELLY

SUPPORTS OF THE VAGINAL OUTLET

RECENT INJURIES OF THE VAGINAL OUTLET AND PERINEUM

External Superficial Tear

Internal and Combined External and Internal Tear

Complete Tear of the Rectovaginal Septum

OTHER INJURIES OF THE VAGINAL OUTLET AND PERINEUM

Relaxed Vaginal Outlet

Old Complete Tear

SUPPORTS OF THE VAGINAL OUTLET

The vaginal outlet, called "outlet" with reference to its parturient function, or introitus, "inlet" or "vaginal entrance" from its sexual function, forms the inferior extremity of the vaginal canal communicating with the external genitalia beneath the pubic arch. While the vaginal canal above and within the pelvis is broader and more capacious, inferiorly it suddenly narrows down to an exit, a canal about 4 centimeters long.

The posterior wall of the vagina in a sagittal section of the body forms a flattened S with the convexity of its lower curve directed forward behind the pubic arch. The funnel shape of the vagina—broad above and contracted below—appears most distinctly upon placing in the knee-chest posture a woman who has never borne children and letting in air, when the intrapelvic portion of the vagina balloons out, while the outlet or introitus remains tightly contracted under the pubic arch.

The old long-prevalent theory that the closure of the outlet and its snug position beneath the pubic arch are dependent upon a wedge of tissue, a so-called "perineal body," acting like a cork plugging a bottle, is obviously erroneous. In consequence of this false conception, many absurd and unnecessary operations have been devised and extensively employed. The error is evident upon examining the vaginal outlet where the vaginal outlet and anus are seen, both lifted well up under the pubic arch, and upon introducing the index finger into the vagina the pubic arch is felt in front, while posteriorly a broad, rounded resilient band of muscular tissue, the levator ani, the chief support, stretches behind the outlet from the right to the left pubic ramus. This examination readily demonstrates that the introitus is but a narrow chink

between this posterior muscular band and the pubic arch. By making backward pressure upon the posterior wall of the vagina just within the introitus the band yields, to return to its former position as the pressure ceases.

The real supporting mechanism of the outlet is not, therefore, a perineal body, but the intact anterior portion of the levator ani aided by the transverse perineal and the sphincter vaginal muscles. The broad, rounded levator arises



FIG. 196.—NORMAL VAGINAL OUTLET IN A NULLIPARA.

Vagina completely hidden; no flattening across anus and gluteal furrow as in relaxed outlet. Concentric furrows around fourchet are not, as a rule, found in the virgin.

on each side of the inner surface of the pubic ramus and passes back around the lateral vaginal wall to unite with its fellow behind the rectum, its fibers being intimately interwoven with the lateral walls of the rectum. These important anatomical relations may readily be detected in life by making pressure in each lateral sulcus of the vagina with a finger also in the rectum.

It is apparent that the vaginal outlet is without any efficient direct means of closure such as would be afforded by a powerful sphincter, but depends largely for its support upon the indirect action of the levator. By the normal tonus of this muscle, the lower end of the rectum is snugly lifted up under the pubic arch where the vagina is flattened out and held up between the two. It is important to notice that the plane of the arch, as it lies in front of that of the

levator fibers, renders the closure far more efficient; this shearing action gives the sigmoid curve to the lower vagina. (See also Chapter XVIII.)

With rare exceptions, the important injuries to the vaginal outlet affect its caliber alone and arise during parturition. Often, instead of a gradual and all-round dilatation effected by the repeated impacts of the advancing and retiring head, the yielding occurs suddenly and in one place, with the rupture of the muscular fibers. The parturient canal represents a funnel within a funnel, the uterus and cervix representing the upper funnel set within the upper vagina and outlet as the lower funnel. It is a matter of surprise that both the contracted outlets, cervix and lower vagina, are not oftener damaged during the extrusion of the greatly disproportionate fetal ovoid. The vaginal outlet may be injured from without by such accidental causes as falling upon a chair post, goring by cattle, or in a child by sliding down a haymow on to a pitchfork handle or sliding down a balustrade on to the low newel post.

The treatment of cystocele, rectocele, and enterocele will be found in the chapters by George Gray Ward.

RECENT INJURIES OF THE VAGINAL OUTLET AND PERINEUM

Recent obstetrical injuries may for practical purposes be classified as: External superficial tear; internal and combined external and internal tear; and complete tear of the rectovaginal septum. In extremely rare instances a central rupture of the perineum allows the child to pass, leaving the introitus intact.

External Superficial Tear.—The simplest tear begins at the fourchet, extends backward through the skin in the medial line, and involves the superficial lax tissue at and adjacent to the fourchet; it may extend up into the vagina as far as the posterior column—the commonest and relatively least important injury, in no wise affecting the supporting structures. The only object of an operation here is to anticipate healing by granulation, and it is hardly to be recommended.

In its slighter forms, the external tear needs no attention other than strict cleanliness.

Internal and Combined External and Internal Tear.—Another common parturient injury begins in the mucosa at the fourchet or the hymen and extends some 4 or 5 centimeters up the vagina into one or both lateral sulci. Here, the head of the child often starts a tear which is converted into a more or less extensive rupture by the shoulder following, plowing its way between the levator fibers and their rectal attachments on one or both sides. This injury continued out on to the perineum forms the combined external and internal laceration.

Neglect of such an injury often results in the relaxed, gaping, broken-down vaginal orifice.

Immediately after birth, with the separation of the labia, bringing the posterior vaginal wall under a good light, the irregular, ragged, bleeding, torn surfaces stand out in marked contrast with the smooth discolored vaginal walls, and the extent of the injury is easily ascertained.

The lacerated surfaces are best repaired at once, or at the latest on the following day; a few sutures skillfully applied accomplish the work of much denudation and many more at a later date.

The patient should be put on a table in a good light, on a perineal drainage pad, and under local or gas anesthesia (the latter if nervous); the operator deftly and quickly applies the few necessary sutures.

The following instruments are required: Needle holder, medium-sized curved needles, fine chromic gut, fine silkworm gut, scissors, a Sims speculum and two flat retractors.

It is important to secure a neat approximation of as much as possible of the irregular wound surfaces by the sutures within the vagina.

The upper angle of the wound is exposed by lifting the anterior wall of the vagina with the speculum or retractor, and a liberal temporary gauze pack is crowded into the upper vagina to keep the field dry. The sutures are of chromic gut. The first is introduced at the upper angle of the tear, the next about 1 centimeter below this, and so on down to the skin surface, the needle entering from 5 to 10 millimeters from the edge of the wound, according to the condition of the tissues, and emerging at the bottom of the wound toward the operator and reëntering close by, to be brought out again at a point on the vaginal mucosa on the opposite side of the wound at a point corresponding to that of entrance. The second suture is introduced with its loop also directed toward the operator, and so on until the wound is closed. The sutures thus introduced embrace a larger area and serve to lift up the bottom of the tear. If there is an external tear, the now reduced opening on the skin surface is readily closed with a few superficial sutures. Each suture is best tied as introduced, reducing the size of the wound. One or two sutures may be passed on the skin surface, grasping the levators and holding them in place in the wound. Silkworm gut sutures softened in warm water form the best material. With skill acquired by practice, it will often be possible to close all the parts of the wound with a continuous fine buried chromic gut in one or two layers, using occasional interrupted superficial sutures where there is gaping. In the lower wound, the levators must be snugly united by suture. When buried sutures are used here, I think it well to pass one or two fine splinting silkworm gut sutures from the perineal skin surface down into the depths in a figure eight, grasping the levators, and emerging on the skin of the opposite side. These must comfortably approximate the surfaces to allow for swelling, but must not be tied tight.

I mention but to condemn the practice of closing such a tear by suturing wholly on the skin surface, neglecting an accurate union of the vaginal injury,

which then accumulates secretions and defeats union in its most important part.

It is unnecessary to keep the knees bound after the patient becomes conscious, nor is there any objection to turning carefully in bed and elevating the knees.

Avoid use of a catheter if possible, but take care that the bladder does not become overdistended or accumulate residual urine. The bowels should be opened within two days and kept soft, avoiding straining during defecation.

The sutures may be removed in from eight to ten days.

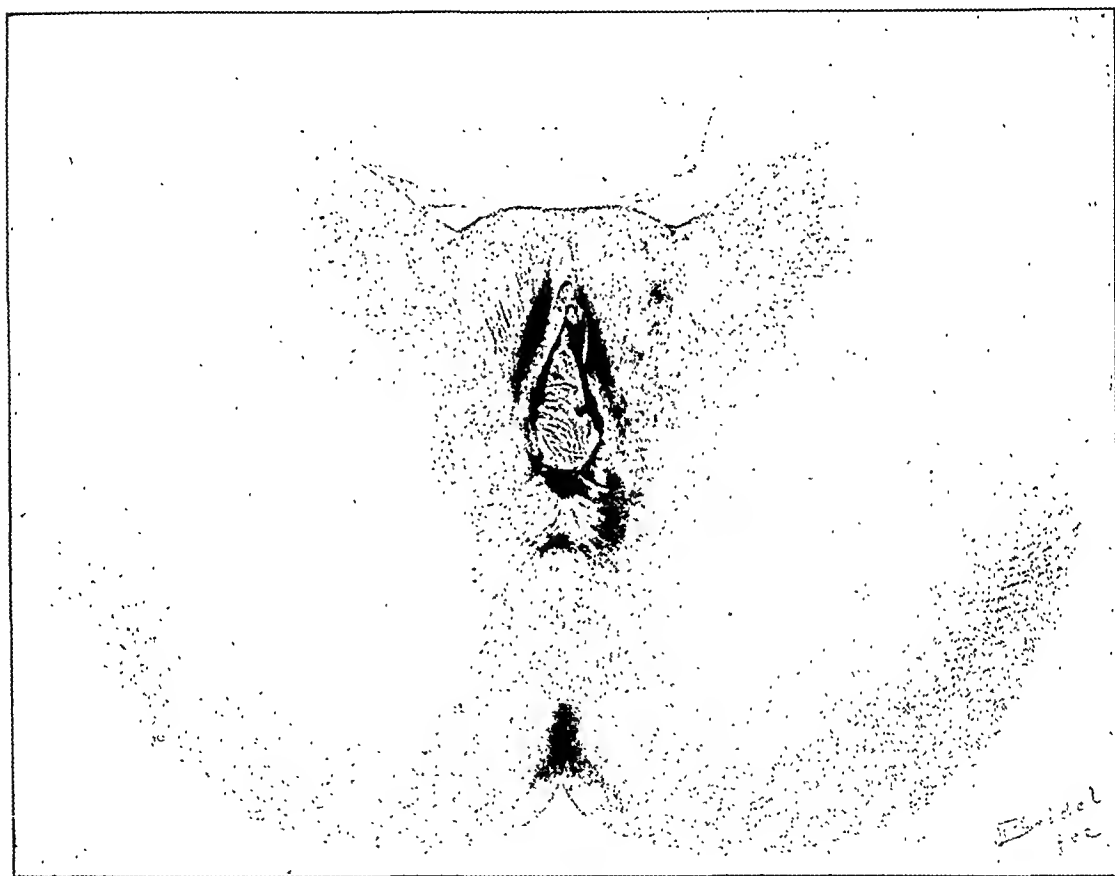


FIG. 197.—COMPLETE TEAR OF RECTOVAGINAL SEPTUM. CHARACTERISTIC PENTAGONAL FORM.

Opening filled with anterior vaginal wall. At each end of horizontal bar of pentagon and below are slight depressions, indicating sphincter pits.

The patient should stay abed twelve days and for a month should go about with care, avoiding hard work and lifting.

Complete Tear of the Rectovaginal Septum.—This laceration begins at the fourchet, passes through skin perineum in the median line, and through the sphincter ani, extending for a variable distance up the rectovaginal septum. The rectal tear is the serious part of the complication as it destroys the function of the sphincter, causes incontinence of feces and flatus, and renders a sensi-

tive patient from company and enforces the life of a recluse. Curiously enough, when the operation is not done at once, the patient sometimes nurses her malady for years.

The bowel is well emptied and a loose pack inserted in vagina and rectum

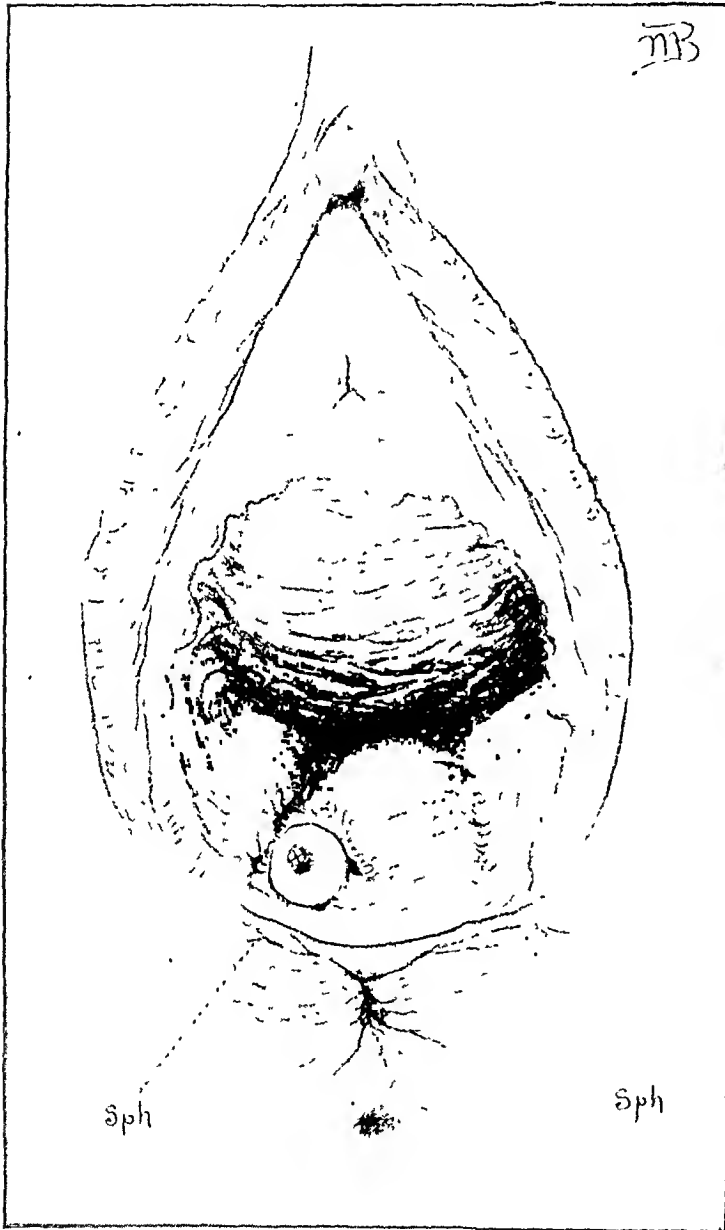


FIG. 198.—COMPLETE TEAR OF PERINEUM, WITH WELL-DEFINED SPHINCTER PITS AND RETRACTION AND THICKENING OF MUSCLE, WITH A DEEP DIMPLE BEHIND.

A vaginal cyst, due to inclusion of vaginal mucosa in healing process, in right sulcus in scar area.

without straining and every second day afterwards. This is sometimes best effected with the patient lying on her side.

She should remain in bed at least two weeks, the silkworm gut suture being removed on the eighth or tenth day.

to prevent contamination. The first step is to close the tear in the bowel by a fine continuous chromic catgut suture applied on the rectal surface, beginning above the upper end of the tear and embracing only mucosa and submucosa. The rest of the wound is closed with a continuous suture as in the combined external and internal tear, with the exception of the first layer at the bottom which must be placed with extreme care and accuracy. Throughout the entire procedure, the wound must be kept clean and dead spaces avoided. Special sutures are necessary for the levators, and the ruptured sphincter muscle is repaired by a fine direct buried gut suture and an additional silkworm gut suture entering and reappearing on the skin surfaces, transfixing the ruptured muscle so as to splint it while healing.

The bowels should be moved on the third day

OTHER INJURIES OF THE VAGINAL OUTLET AND PERINEUM

Relaxed Vaginal Outlet.—"Relaxed outlet" describes a loose, gaping introitus, a condition which is more frequently observed after multiple childbirth, each successive delivery distending the orifice, until it appears like the mouth of a bag without its drawstring, as T. A. Emmet was wont to describe it. Although common, it is generally recognized under the guise of an attendant feature, as a "rectocele," "cystocele," or "rectocele and cystocele," or "laceration of the perineum," in varying degrees.

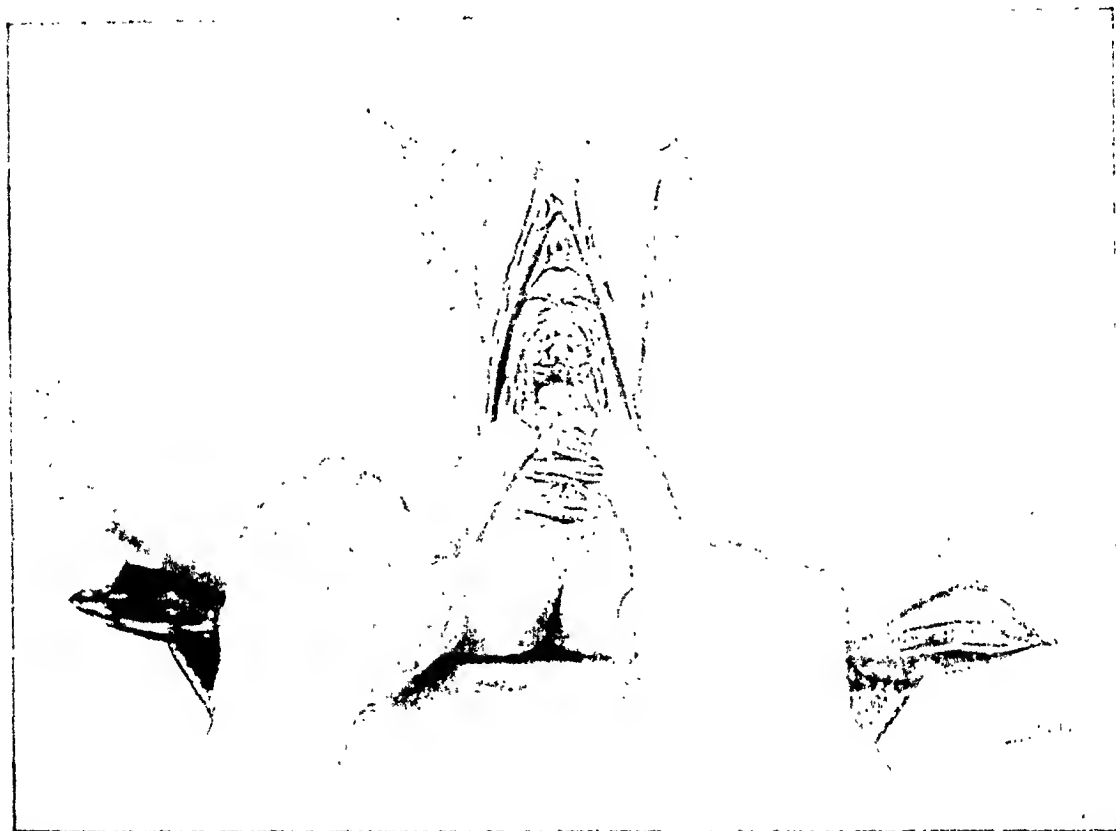


FIG. 199.—METHOD OF DEMONSTRATING RELAXED VAGINAL OUTLET BY HOOKING FINGERS IN VAGINA ON BOTH SIDES AND PULLING OUTWARD AND BACKWARD.

Entire vagina and cervix exposed by fingers as by speculum.

Upon inspection, the cleft of the buttocks appears flattened and broad; the anus is often wide, somewhat everted, and displaced backward, and the sphincter ring is prominent. The skin perineum is often preternaturally deep and the fourchet intact, or the perineum is torn even as far back as the sphincter ani. An intact deep perineum has long been a gynecological stumblingblock on account of an inveterate habit of estimating functional activity and efficiency by the depth of the skin surface; a "good perineum," signifies that the distance from fourchet to anus measures 2.5 centimeters or more, whence the faulty conclusion is drawn that the support at the outlet must likewise be

“good.” The fact is that in many of the worst forms of relaxation the perineum is deeper on the skin surface than before childbirth, a condition due to the overstretching of the external skin at the time the outlet was broken down.

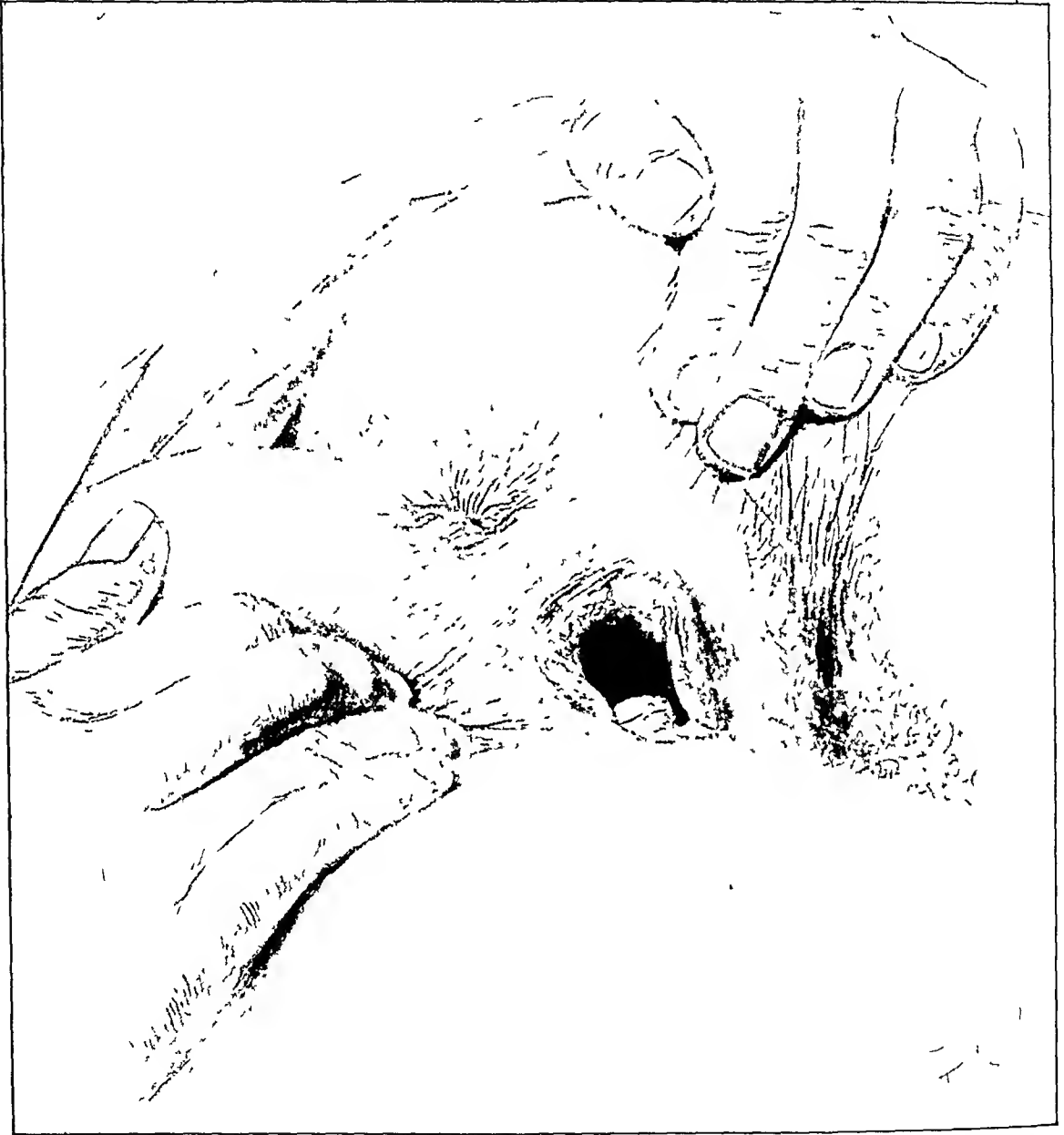


FIG. 200.—TEST FOR RELAXED VAGINAL OUTLET; POSTERIOR VAGINAL WALL DROPS WELL AWAY FROM ANTERIOR WALL BY PLACING PATIENT IN SIMS POSTURE.

External skin perineum well preserved, but there is large, lax, gaping orifice.

On separating the labia in a case of relaxed outlet, the vaginal walls appear more or less pouting, and either the anterior or posterior walls may protrude markedly. Sometimes lateral, anterior, and posterior walls all protrude.

The relaxed condition is demonstrable in a variety of ways. Instruct the patient to bear down as in defecation, and both anterior and posterior walls

roll out and bring into view a considerable portion of the lower vagina. We are thus enabled to estimate the effects of lifting, walking, or straining at stool upon such a patient. If a finger is placed upon the cervix uteri, during the act of straining, it is felt descending in the axis of the vagina toward the outlet. The descent is especially marked and sometimes appreciated for the first time when the examination is made in the erect posture; this reveals the effect of being on her feet all day.

Upon placing the patient in the left lateral or the knees-chest posture and separating and pulling back the upper buttocks, the air rushes audibly into the vagina and the posterior vaginal wall drops away from the anterior, leaving the gaping outlet as a large hole in the pelvic floor and clearly demonstrating the lack of support, Figure 200.

Palpation in the dorsal position reveals other important deviations from the normal. The perineum is often but a thin lax partition easily caught between thumb and forefingers and lifted to cover the urethra and even the clitoris. Further palpation shows that the strong lifting anterior levator fibers stretching from ramus to ramus, supporting the outlet, are wanting, and in their place the levator fibers hang more or less parallel to the lateral walls of the vagina. There is both a change in the direction of the lower levator and a difference in the size of the levator loop surrounding the posterior vaginal wall.

The lesion is not always the same; the levator on one side may remain intact, while its fellow is severed from its rectal and vaginal attachments.

A relaxed outlet is often much more obvious under an anesthetic.

It is a good plan to measure and record the degree of relaxation by using a calibrator, Figure 201. Opening the instrument with gentle pressure until resistance is felt, the degree of relaxation is read off on the graduated rod.

The rational treatment for the relaxed broken-down outlet is resection. There are in general two modes of operating: The posterior median and the

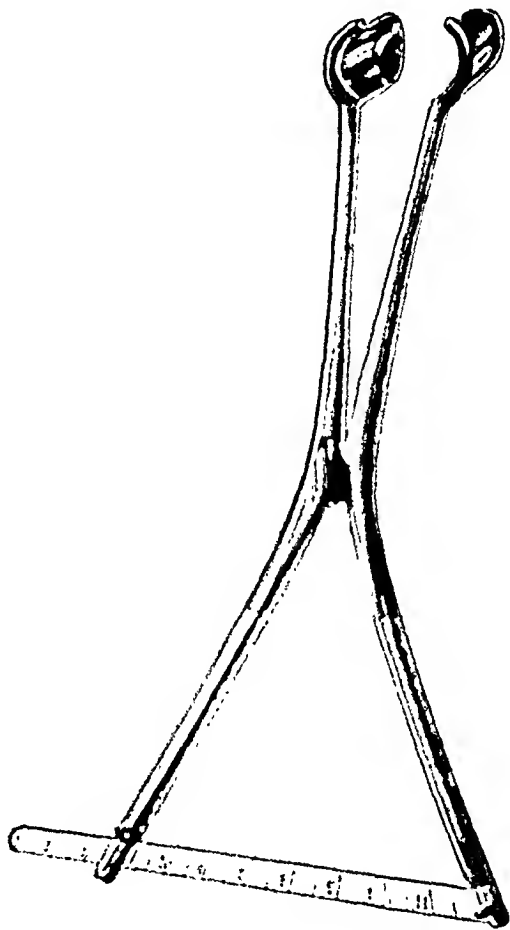


FIG. 201. CALIBRATOR FOR MEASURING DEGREE OF RELAXATION OF VAGINAL OUTLET; GRADUATION IN CENTIMETERS.

Blades closed and introduced just within outlet, then opened as far as they will separate easily. Figures on scale measure degree of relaxation.

posterior bilateral exsection of the superfluous tissue, followed by suture. Since the natural outline of the vagina in cross section near the external orifice is somewhat H-shaped, the obvious inference is that the vaginal tissues will unite to best advantage in the limbs of the H—that is in the sulci. This is the assumption in the bilaterally symmetrical operations extending up both sulci, following the initiative of T. A. Emmet, pioneer genius in all plastic procedures.

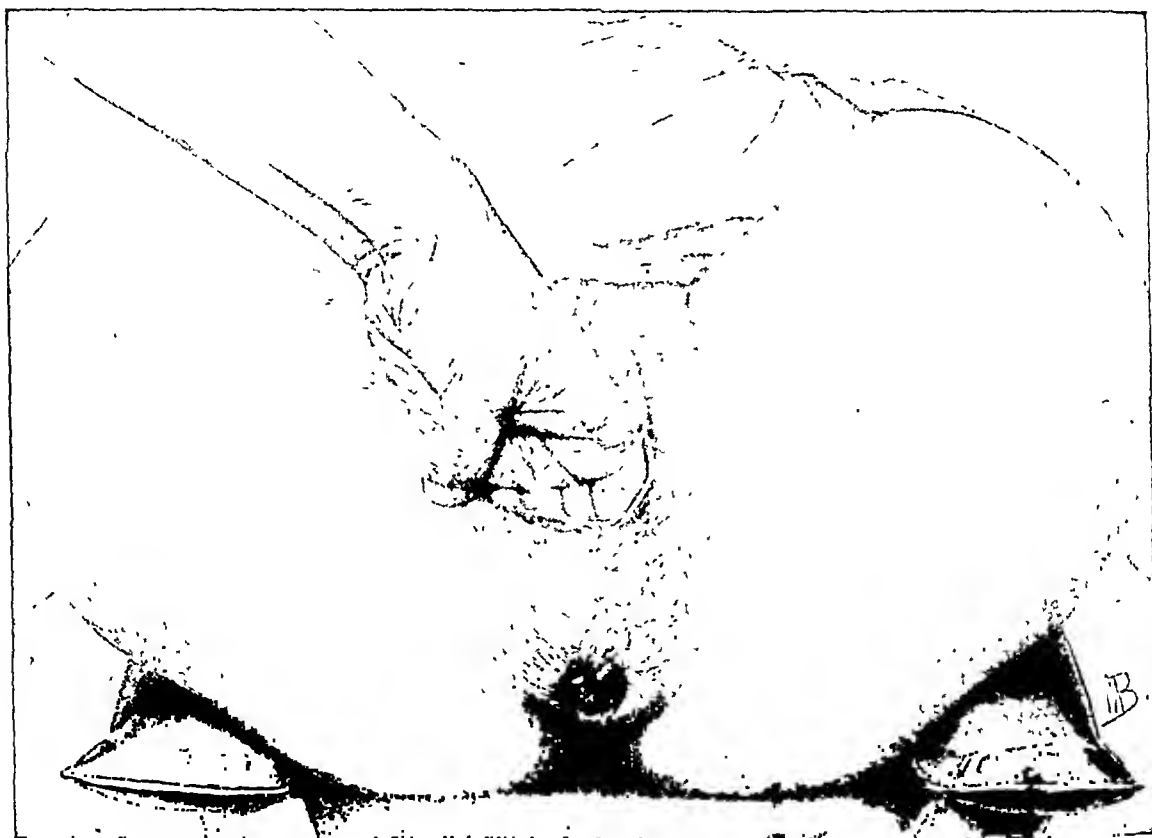


FIG. 202.—DEMONSTRATION OF EXTREME RELAXATION.

Four fingers easily introduced into vagina and thin pelvic floor pushed out, everting rectum and showing entire absence of support.

It is necessary to exaggerate slightly the effect of the operation in narrowing the vagina in order to counterbalance a slight relaxation which always follows.

The extent of the denudation is determined by that of the relaxation.

This operation can best be understood by a reference to Figures 203 to 207. The inside sutures closing the denudation in the sulci should be of formalin or a rather fine chromic catgut. The crown suture is best of silk-worm gut. I cite this operation because it is so widely used, but no longer with the heartiest approval. It does give an excellent restoration, but a more physiological procedure is one which makes a more deliberate effort to bring back the levatores ani to their supporting function and pays scant attention

to the sulci, uniting the tissues in the posterior median plane. The external sutures should be removed from the eighth to the tenth day. Those inside may remain several weeks. The immediate result of this operation is a complete restoration, and even the hymen is often restored.

A procedure to which I incline more and more of late years approximates

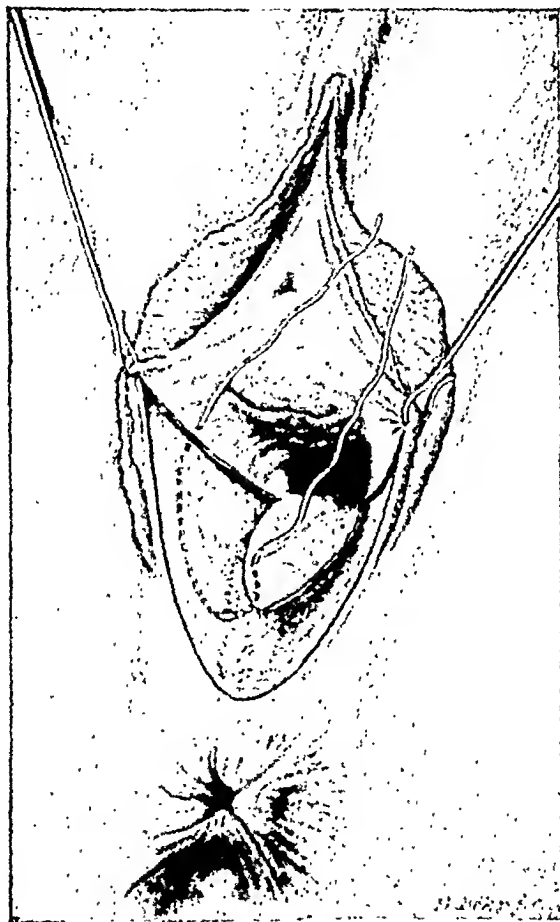


FIG. 203.—RELAXED VAGINAL OUTLET.

Silkworm gut tension suture placed in triangle on right side. Dotted lines represent part of suture concealed under surface. Short piece of suture visible as white line at bottom of denudation is part exposed by bringing needle out at bottom of wound and reentering it close by.

the old Hegar posterior median triangular denudation, coupled with a denudation of the anterior levator loop fibers and their approximation by buried permanent sutures in the depths of the wound. The steps are as follows (Figures 208 to 211):

The lateral points of the denudation are selected in the hymeneal circle, on each side at a distance below the urethra estimated to leave a sufficiently large introitus when they are united. Another point outlining the denudation area is the lowest part of the introitus above the anal ring, and a fourth is located on the protruding rectocele far enough up to take in all the relaxed vaginal

tissues and to resect the vagina satisfactorily when the denudation is completed and the tissues drawn together. Each of these points is fixed with an Allis forceps.

The denudation is quickly made by cutting from forceps to forceps on the outside and then up into the vagina from the upper side to the forceps above

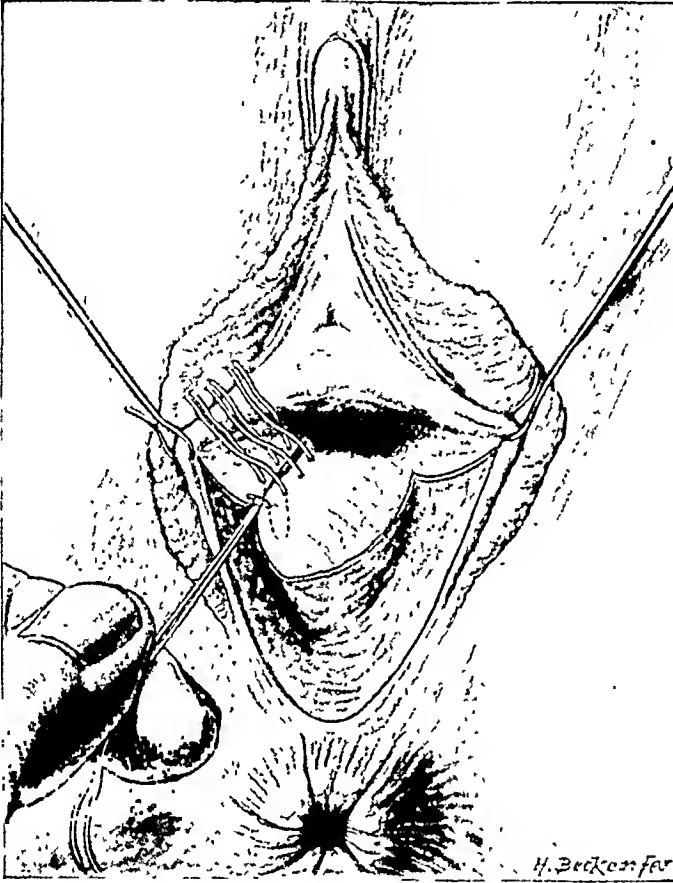


FIG. 204.—RELAXED VAGINAL OUTLET.

Silkworm gut suture tied and pulled down, exposing catgut sutures in place, ready to be tied, closing accurately upper part of denudation, already brought loosely together by silkworm gut. These catgut sutures pass deeply into tissues so as not to leave a pocket in wound below them.

on the posterior vaginal wall. The denudation is completed best with curved or straight scissors, stripping off the entire thickness of the vagina and avoiding any injury to the rectum which, however, usually lies well back.

The anterior margin of each levator muscle is now located with the index finger and dissected free for from 2 to 2.5 centimeters. Then pass a silk or linen suture through the levators from side to side so that when the suture is tied they are brought snugly together and the outlet tightened up; two sutures may be necessary.

The incision is closed in the more relaxed cases by uniting the upper angle of the wound with three or more interrupted catgut sutures. The rest of the

wound is closed with a continuous formalin gut suture which starts above in the vagina at the angle. The free end of the suture is dropped under the loose levator suture and hangs out on the perineum. The operator then closes the wound in its deeper parts with the running suture down and then up and back again just under the vaginal mucosa and the perineal surface.

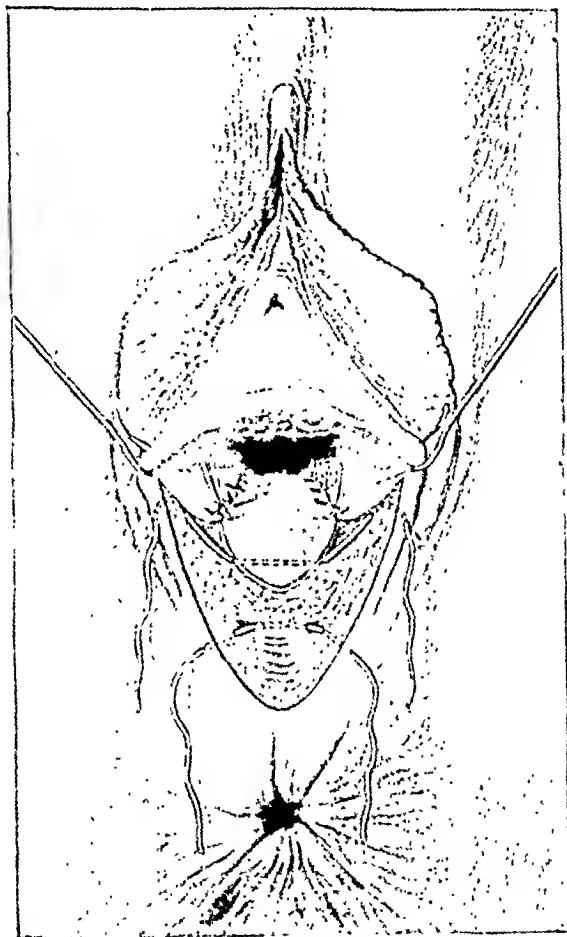


FIG. 205.—RELAXED VAGINAL OUTLET.

Inside sutures introduced and tied in both sulci. Gathering suture of silkworm gut introduced above across angles, but not tied. Auxiliary suture introduced to close wound below; this also left untied.

The sutures through the levator muscles must be tied and left to be buried before the continuous closing suture reaches them. The last step in the closure is to pick up the free end dropped in the beginning on to the perineum and bring it through the skin on one side, while the needle carrying the continuous suture is brought through the other, and tie them, thus closing the whole large area with only one suture visible.

If the rectocele is extensive, the denudation must ascend higher, sometimes even to the vaginal vault. If an anterior colporrhaphy is done

tioned between the two. It is not wise to denude extensively on both surfaces at once; the upper three-fourths of the vagina, however, will stand both an anterior and a posterior reduction better than the lower. Sometimes with careful dissection one finds a layer of fascia in the posterior vaginal wall corresponding to that between the bladder and the vagina. This should then be utilized as a valuable asset in the closure. In some three instances I have

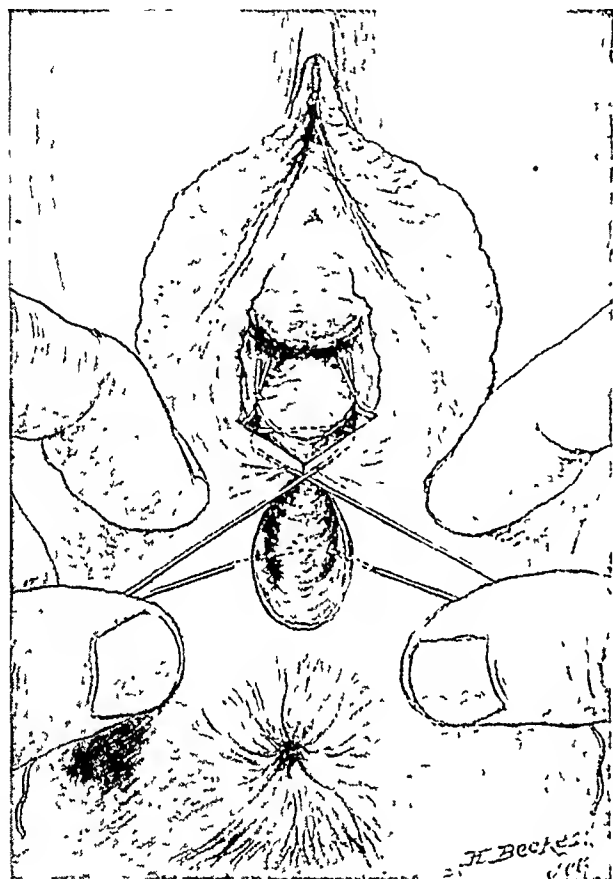


FIG. 206.—RELAXED VAGINAL OUTLET.

Gathering suture above draws tissues together.

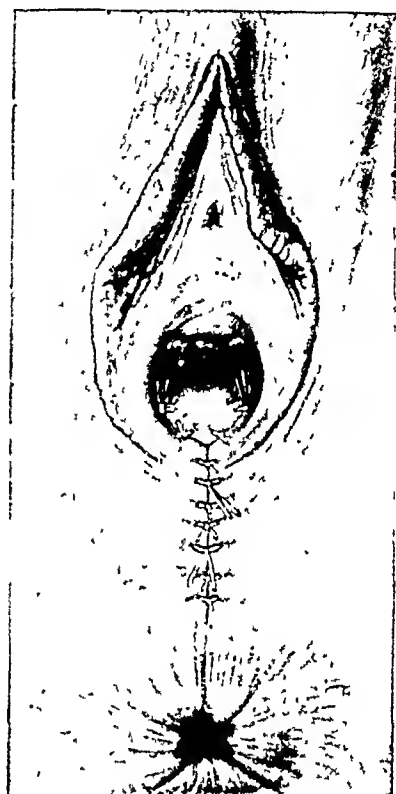


FIG. 207.—RELAXED VAGINAL OUTLET.

Operation completed. Sutures with longer ends, two inside and two outside, of silkworm gut; others of catgut.

met with a remarkable hernial protrusion of the small bowels forcing down Douglas's culdesac which simply appeared as a huge rectocele. These cases had been operated upon with an almost immediate return. Percussion and an examination per rectum and in the dorsal and knee-chest posture reveal the nature of the trouble. The operation here consists in a free incision into the sac, the packing of the bowels up and out of the way, and the liberation and removal of the entire peritoneal sac which is tied off and sewed up well above the cervix. The tissues lateral to the cervix are then sewed together from side to side with a permanent suture and the vaginal wound closed from above downwards.

Chapter XX deals with this important operation in much greater detail.

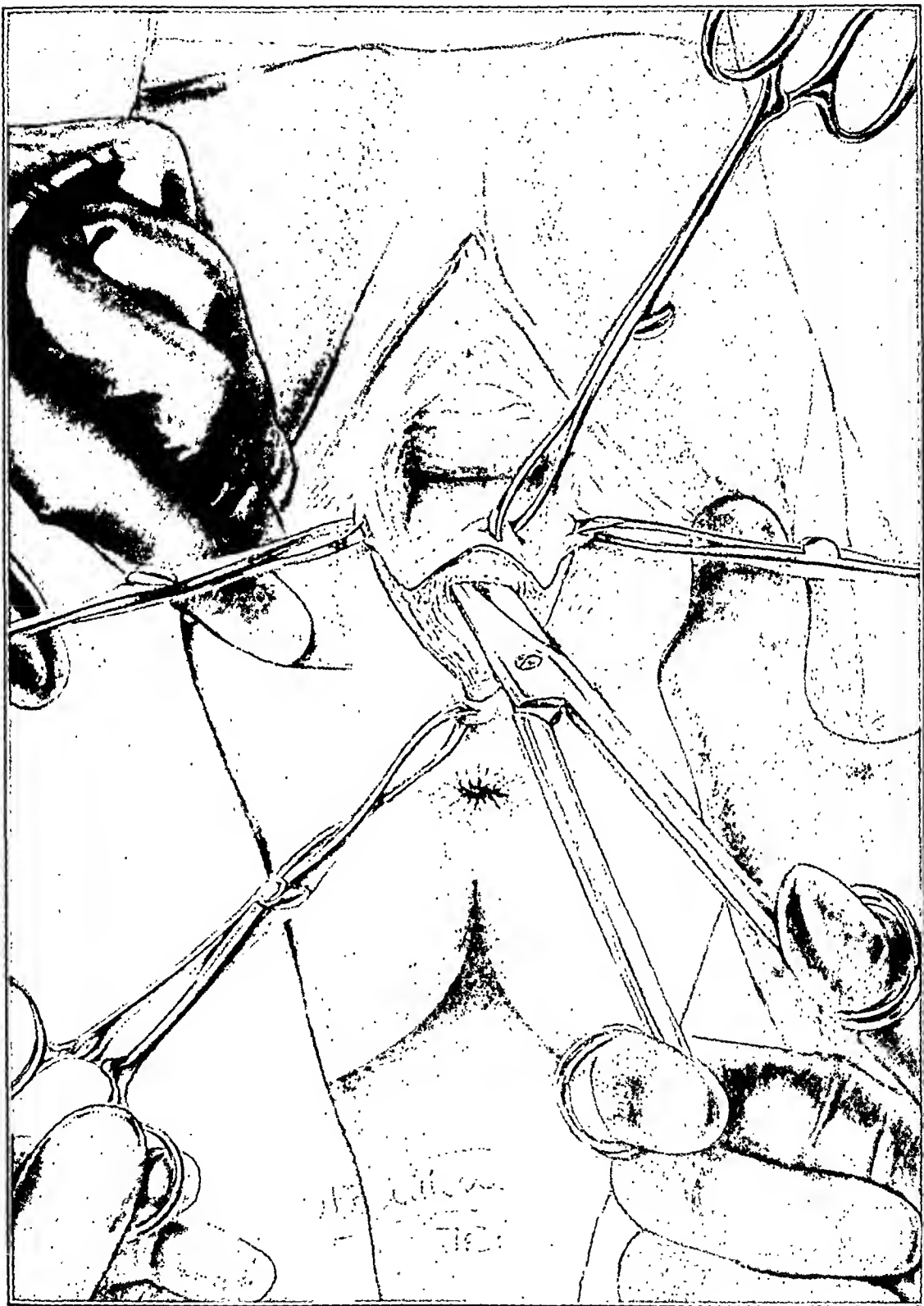


FIG. 208.—DENUDATION OUTLINED BY ALLIS FORCEPS AND SEMICIRCULAR INCISION AT VAGINAL ORIFICE FOLLOWED BY DETACHMENT OF VAGINAL FLAP, USING SCISSORS AS INDICATED TO FOLLOW LINE OF LEAST RESISTANCE BETWEEN VAGINA AND RECTUM.

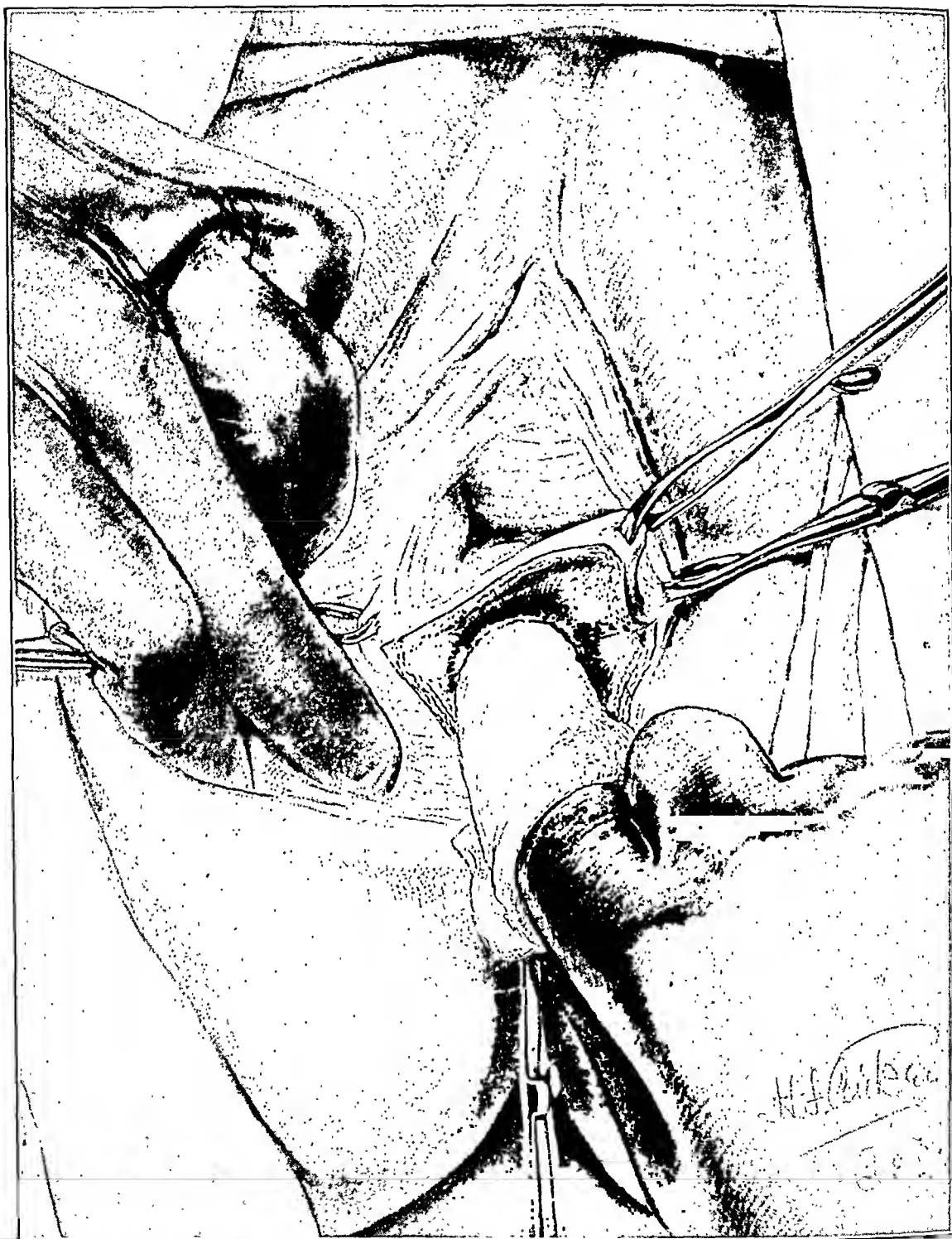


FIG. 209.—FURTHER DETACHMENT OF LOWER PORTION OF VAGINA BY BLUNT DISSECTION WITH GAUZE-COVERED FINGER REACHING OUT Laterally TO LEVATOR MUSCLES.

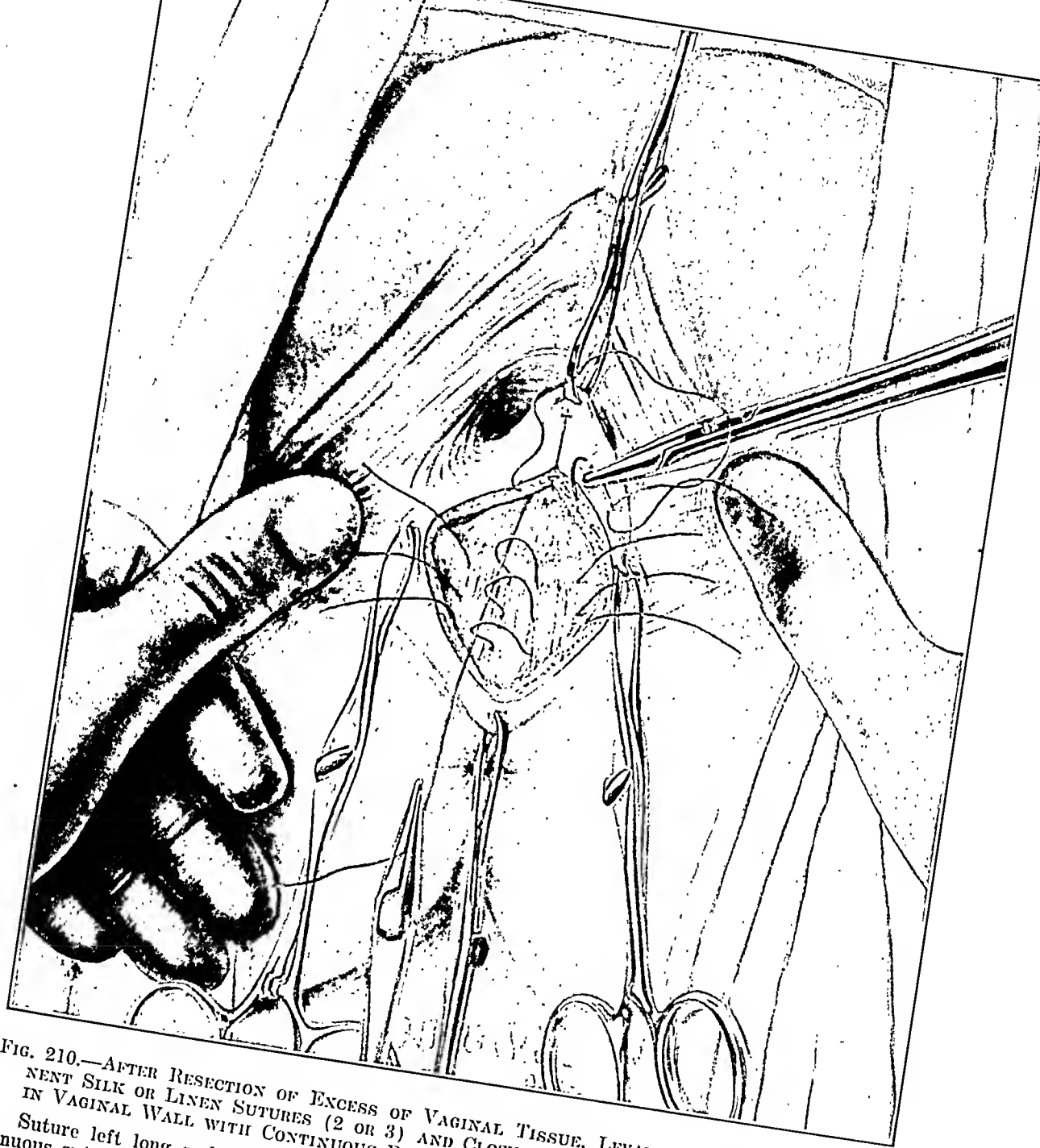


FIG. 210.—AFTER RESECTION OF EXCESS OF VAGINAL TISSUE, LEVATORS UNITED BY PERMANENT SILK OR LINEN SUTURES (2 OR 3) AND CLOSURE OF DEFECT CREATED BY RESECTION IN VAGINAL WALL WITH CONTINUOUS RATHER FINE CHROMIC GUT SUTURE.
Suture left long and grasped in forceps below is used to complete operation when continuous suture reaches lowest point and is tied to it. (T. S. Cullen's method.)

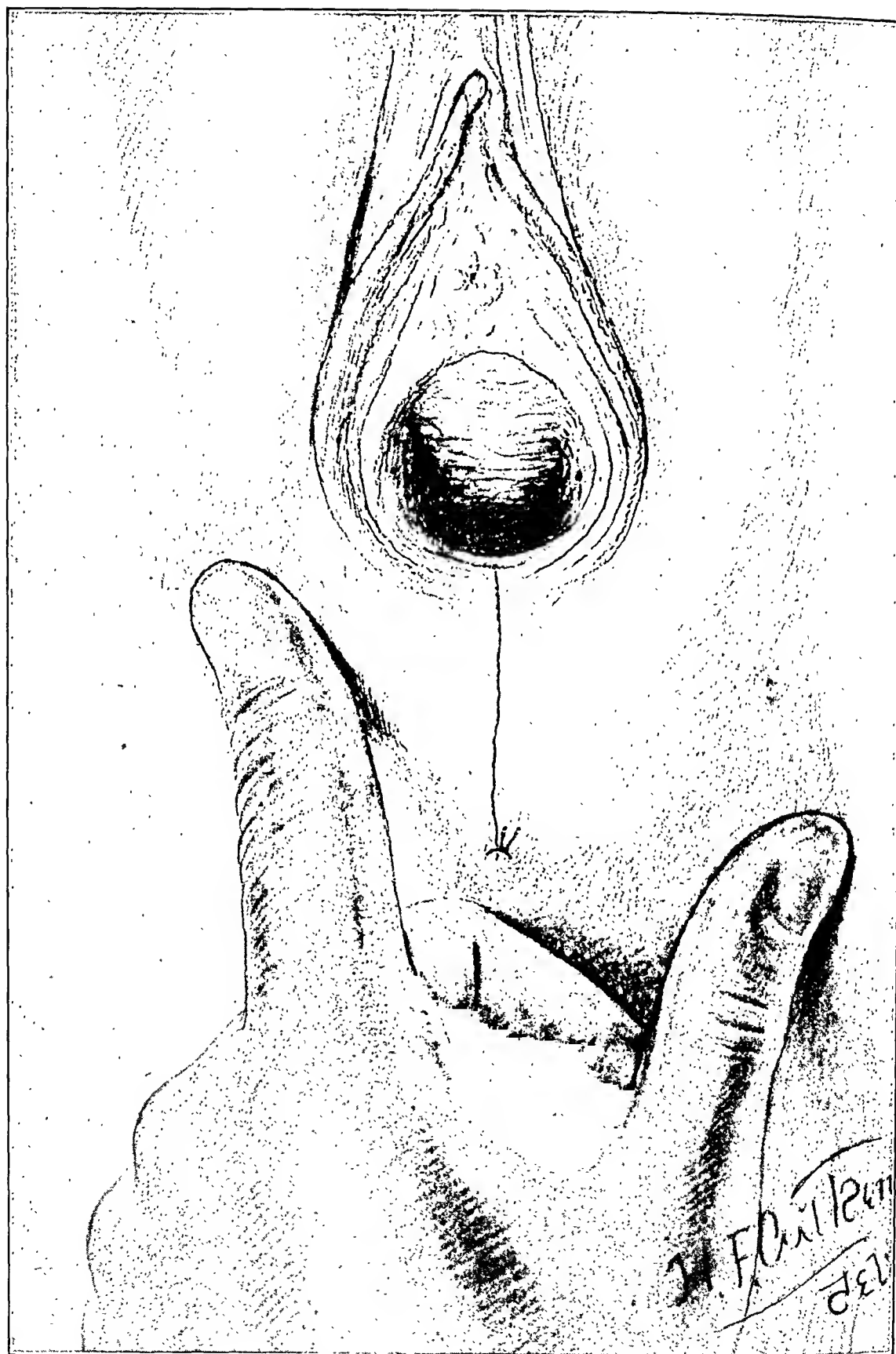


FIG. 211.—OPERATION COMPLETED.

Old Complete Tear.—The ideal procedure for closing a complete tear aims at two improvements upon older methods: First, an apron of tissues turned down from the torn septum avoids the passage of any sutures on the rectal surface; second, the ends of the sphincter muscle are united directly by suture.

The apron or flap should be fairly thick to prevent a slough from ischemia; the operator must also avoid cutting close in to the rectum. After turning down the flap, the tissues in the sphincter pit are picked up with dissecting forceps or a tenaculum, and the operator cuts skill-

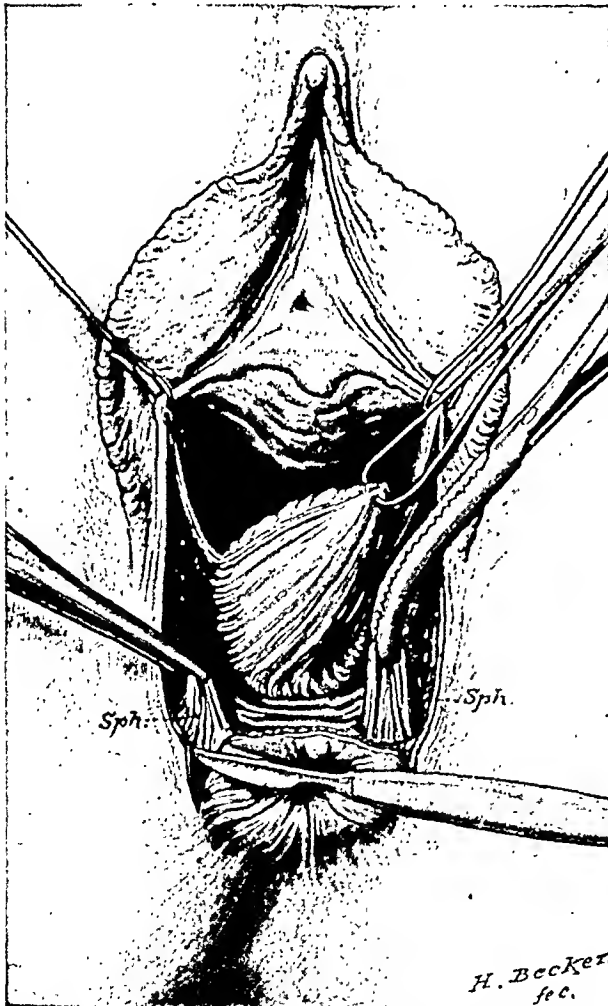


FIG. 213.—TWO LATERAL INCISIONS AND DISSECTION OF APRON SERVE TO LAY BARE SPHINCTER AREA. MUSCLE THEN PICKED UP AND DISSECTED OUT.

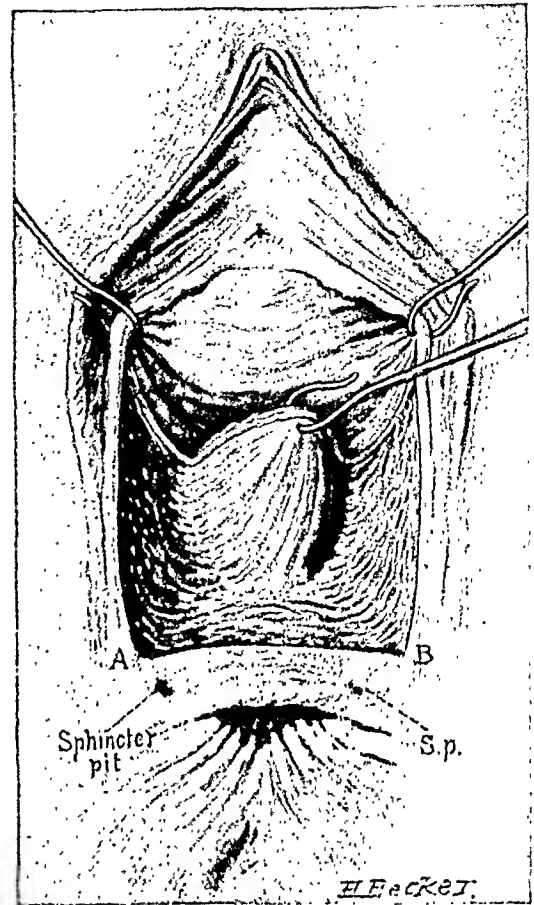


FIG. 212.—DENUDATION IN COMPLETE TEAR IN WHICH TISSUE BELOW A-B HAS BEEN LEFT TO FORM AN APRON TO BE DISSECTED LOOSE AND TURNED DOWN.

fully in around the elevated point with a pair of curved scissors, first on one side and then on the other, exposing and drawing out the sphincter ends. When this is done on both sides, the ends are united with fine, interrupted, buried, chromic catgut sutures, Figure 214. The denudation and suturing on the vaginal side is similar to that described in the operation for relaxed vaginal orifice. After closure of the sphincter, and after the vaginal sutures have been placed and tied, the wound presents the form shown in Figure 215. Then pass a silkworm gut tension suture, transfixing the

sphincter and grasping the bottom of the denuded septum. The rest of the perineal wound is closed with silkworm gut and catgut. Finally, the sides of the apron are brought together with delicate silk sutures, Figure 216. It will be seen that in this way, all suturing is done entirely outside the bowel. The formation of the little apron was first suggested by C. Warren of Boston. Sloughing of the apron, owing to anemia, sometimes occurs, but as a rule, the necrosis is only superficial. The direct suture of the sphincter ends has been

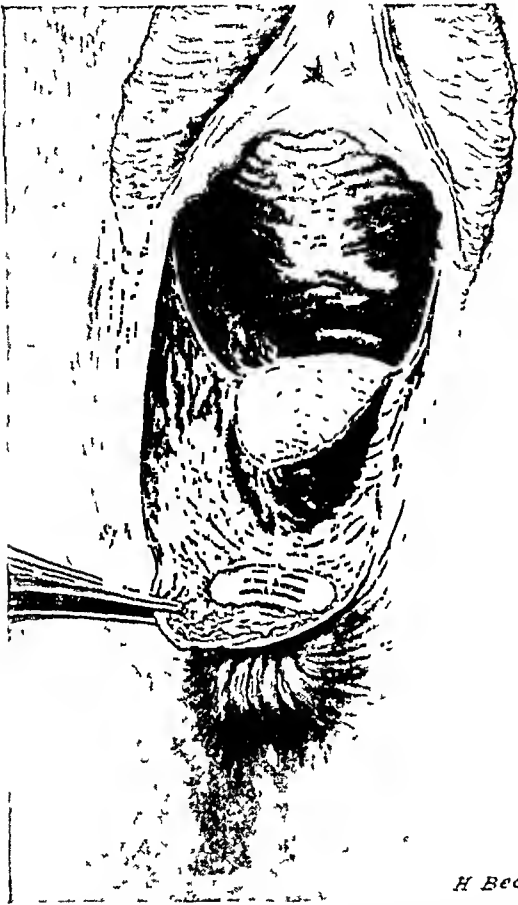


FIG. 214.—SPHINCTER ENDS UNITED BY THREE BURIED CATGUT SUTURES. APRON WHICH PROTECTS WOUND FROM BOWEL HELD BY FORCEPS.

done by Leconte, Baldy, Leopold, Dickinson, and Ristune.

An excellent plan of treating deeper complete tears is that of G. H. Noble (*T. Am. Gynec. Soc.*, 1902, 27), which consists in splitting the rectovaginal septum from side to side to liberate the rectum from the vagina. The next step is to draw down the detached anterior rectal wall and use it in place of the apron described above. Noble's description is:

"The line of incision starts on the external side of the sphincter dimple, at a point close to one end of the sphincter muscle, care being taken not to cut the skin at this point. It follows the edge of the sheath of the muscle, passing between it and the rectal mucosa, making the flap at this point as thick as possible. It then turns upward and forward to the cellular interspace of the rectovaginal septum, splitting it in the

center, and returns on the opposite side to a place corresponding to the starting point. This makes an incision similar to the ordinary flap-splitting operation, except at its extremities. The incision is best made with a pair of sharp-pointed scissors. After cutting through the cicatricial structures to the healthy tissue beneath, two pairs of light compression forceps are placed on the rectal flap some distance on either side of the center, embracing in their grasp the entire thickness of the rectal wall. The left hand should be protected with a rubber glove and the index finger passed into the rectum beyond the angle of the laceration as a guide to prevent perforation of the rectal flap. The forceps are held with the remaining fingers of the left hand, and, as slight traction is made upon them, ridges or bands of tissue will form across the line of incision;

these are cut as they appear. The point of the scissors used in the dissection should be turned slightly in the direction of the vagina, that is, away from the rectum to avoid liability of perforating the latter. Unless care is observed, the tendency will be to cut the flap too thin, so as not to embrace the entire thickness of the rectum; this can be avoided by confining the incision to the cellular interspace.

"After reaching this stage of the operation there is no longer any necessity for the finger in the rectum. It should be with-

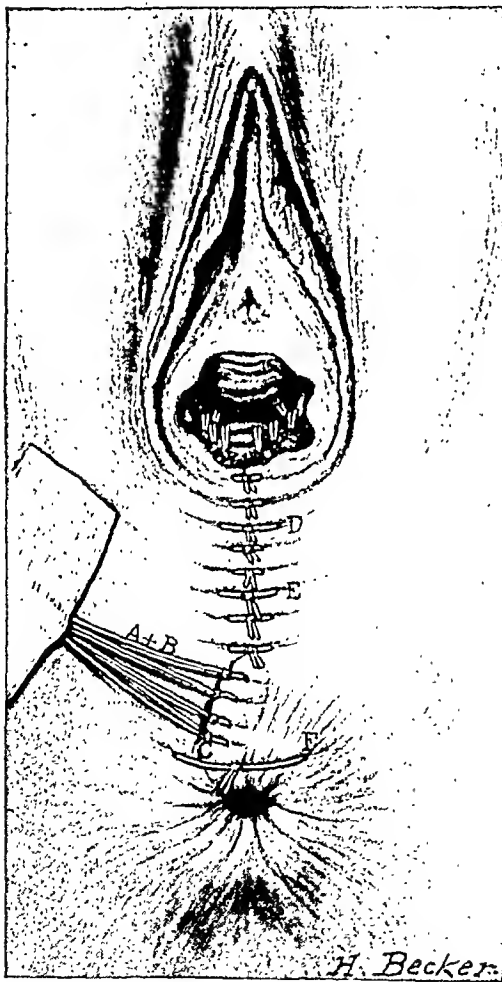


FIG. 216.—AFTER PASSING ALL SUTURES ON VAGINAL AND PERINEAL SURFACES, SIDES OF APRON, A, C, B, BROUGHT TOGETHER BY FINE SILK SUTURES.

If tip of tissue is anemic it can be cut down close to level of surrounding skin.

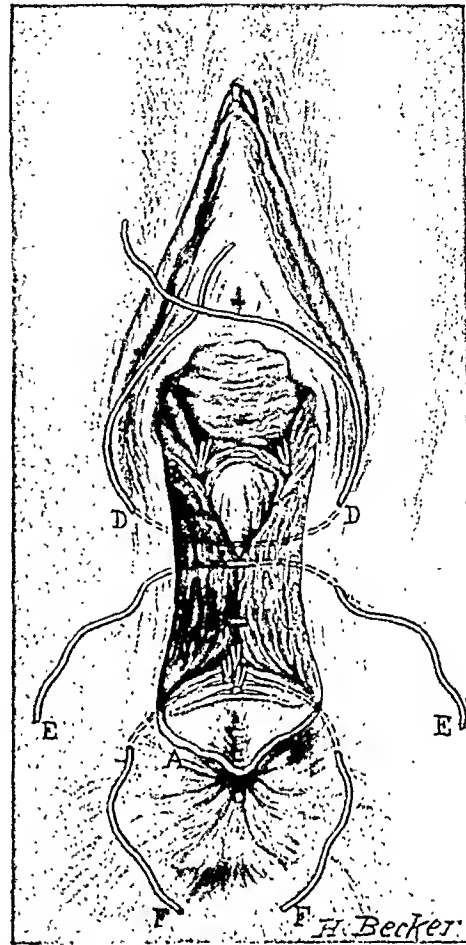


FIG. 215.—THE VAGINAL WOUND CLOSED AS IN OTHER PERINEAL OPERATIONS.

Perineum about to be closed by deep interrupted sutures represented by *D* and *E*. Sphincter muscle united by buried catgut sutures held firmly splinted by silk-worm gut suture *F, F*. Instead of going round the muscle, it is best to make this suture transfix it on both sides, entering and emerging near points *A* and *B*.

drawn, the glove removed, and the hands resterilized. The torn surface of the perineum is next denuded and the excess of the vaginal flap cut away. Two kangaroo or ten-day catgut sutures are inserted deeply into the perineum behind one end of the sphincter muscle, passed to the opposite side, taking up, in crossing, the thickest part of the rectal flap (about its middle portion) without penetration of the rectal mucosa, and returned to the

other end of the sphincter ani, to issue at a point corresponding to the place of introduction (Emmet sutures). In exceptional cases the sphincter muscle may be very much shortened or retracted, and its ends require approximation by buried sutures to secure the best immediate results. When the Emmet sutures are tied the wound is converted into the condition of a simple perineorrhaphy, and then completed by some method employed for incomplete tear."

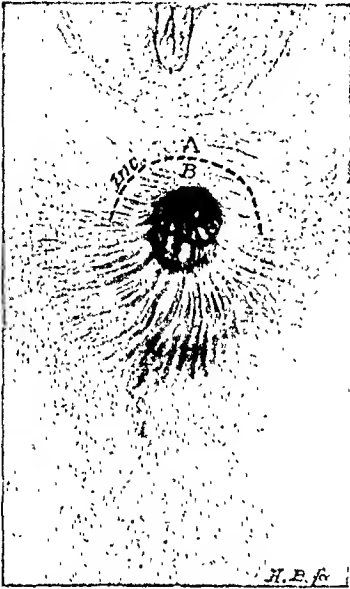


FIG. 217.—INCISION IN PERINEUM, MADE TO EXPOSE SPHINCTER ENDS IN COMPLETE TEAR; PERINEUM RESTORED WITHOUT SECURING SPHINCTER UNION.

One sometimes finds a perineum apparently well restored but with sphincter ends still separated, Figure 217; as a consequence, there is no satisfactory control over gas or liquid fecal movements. The method of operation is to make a horseshoe incision on the perineal surface and turn down a flap toward the bowel, like the apron described; this avoids placing any sutures on the side of the bowel. The ends of the incision must extend far enough down on each side to expose the sphincter ends, usually readily felt between index finger and thumb. After liberating the sphincter for about 1.5 centimeters, the ends are united by two or three interrupted fine

chromic gut sutures. It is well also to pass a silkworm gut suture through the skin behind the ends of the incision, transfixing the sphincter end of one side, passing up into the septum, and then down and out, transfixing the opposite end. Before tying this suture, the buried sutures may be placed as shown in Figure 218. After this the silkworm gut suture may be tied tight enough to relieve the tension on the buried sutures.

The after treatment of these cases may be conducted in one of two ways. Either the bowels, which were well emptied before the operation, are evacuated on the third day following operation, or the evacuation is put off for eight or ten days. If the bowels are to be moved on the third day, it is well to give a dose of compound licorice powder or cathartic pills on the eve of the second day in order to secure the movement the next morning. Great care must be taken to keep the parts from being soiled; it is well to irrigate the perineum with boric acid solution during the evacuation. I formerly kept the bowels locked and fed the patient for from seven to ten, or even twelve days on albumin

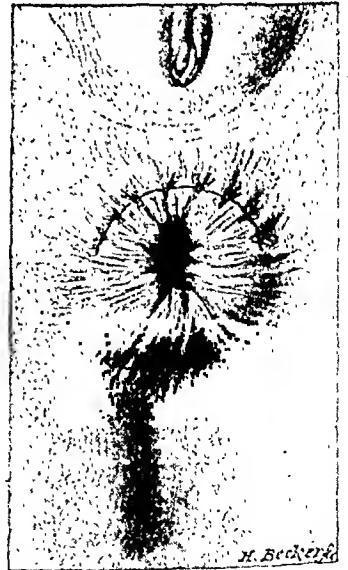


FIG. 218.—SPHINCTER ENDS UNITED AND SKIN WOUND CLOSED.

water, the total amount of albumin given in ten days amounting to about a liter and a half. One begins with 2 teaspoonfuls of albumin in water every three hours, increasing this on the fourth day to 4; on the last day, say the tenth, she receives 2 drachms of compound licorice powder in the evening, followed by an oil enema in the morning. When albumin alone is given, there are no scybala and the action is a normal one unattended by danger or difficulty. But I like better keeping the bowels moving from the third day, limiting the intake of food and giving enemata with a soft catheter well lubricated and passed in the lateral position. The external parts should be well irrigated and a dichloramin-T dressing put on afterwards.

CHAPTER XVIII

FASCIA AND LIGAMENTS OF THE PELVIC FLOOR

LILIAN K. P. FARRAR

ANATOMY

Outlet

Diaphragm

PELVIC

UROGENITAL (UROGENITAL TRIGONE OR TRIANGULAR LIGAMENT)

Upper Floor

INJURIES

Directly Concerned with Cleavage Lines

URETHROCELE

CYSTOCELE

RECTOCELE

ENTEROCELE

Chiefly Concerned with Diaphragms

LACERATION OF CERVIX

LACERATION OF PERINEUM

Prolapse of Uterus

The normal relations of the pelvic organs to the tissues supporting them¹ are so involved that it is hard to visualize them when repairing the injuries resulting from childbirth. Gynecologic lesions necessitate the same definite processes of repair as other surgical lesions, and the steps should proceed with the identical anatomic accuracy. It is, therefore, necessary for the plastic surgeon to have a clear mental picture of the structures making up the pelvic floor as well as their several relations to the three canals which penetrate them on their descent from above downwards. The important relations

¹The text is based upon dissections made by L. K. P. Farrar, as well as upon personal experiences in the operating rooms of the Woman's Hospital, New York, during the past nine years; she desires to make grateful acknowledgment to Julius Tandler of the department of anatomy in the University of Vienna for the anatomic material, and further and most especially to George Gray Ward for the privileges of the association, inspiration, and help of many years. The text also takes cognizance of the descriptions of McMurrich, Peter Thompson, Waldeyer, Moritz, Paramore, Cunningham, Poirier et Charpey, Halban, and others. The illustrations are from the work of Halban and Tandler and Testut et Jacob, and from the atlases of Eduard Martin and of Savage. The theory and illustrations of the cleavage lines are from studies of Robert L. Dickinson; warm thanks are due to him for kindly help and to Charles R. Stockard, professor of anatomy, Cornell University Medical College, for the theory of the formation of the urogenital orifices and the decussation of muscles in the pelvic floor, and to Charles V. Morrill, his associate, who has read the text and made many helpful suggestions.

of the pelvic structures to be borne in mind in the operating room, and the reasons for the surgical procedures described later, are here presented briefly:

Anatomy.—Outlet.—The pelvic outlet is a lozenge-shaped space bounded anteriorly by the symphysis pubis, posteriorly by the tip of the coccyx, and laterally on each side by the rami of the pubes and ischia and the great sacro-sciatic ligaments. The pelvic floor, including all the structures closing the pelvic outlet from peritoneum above to skin surface below, consists of two

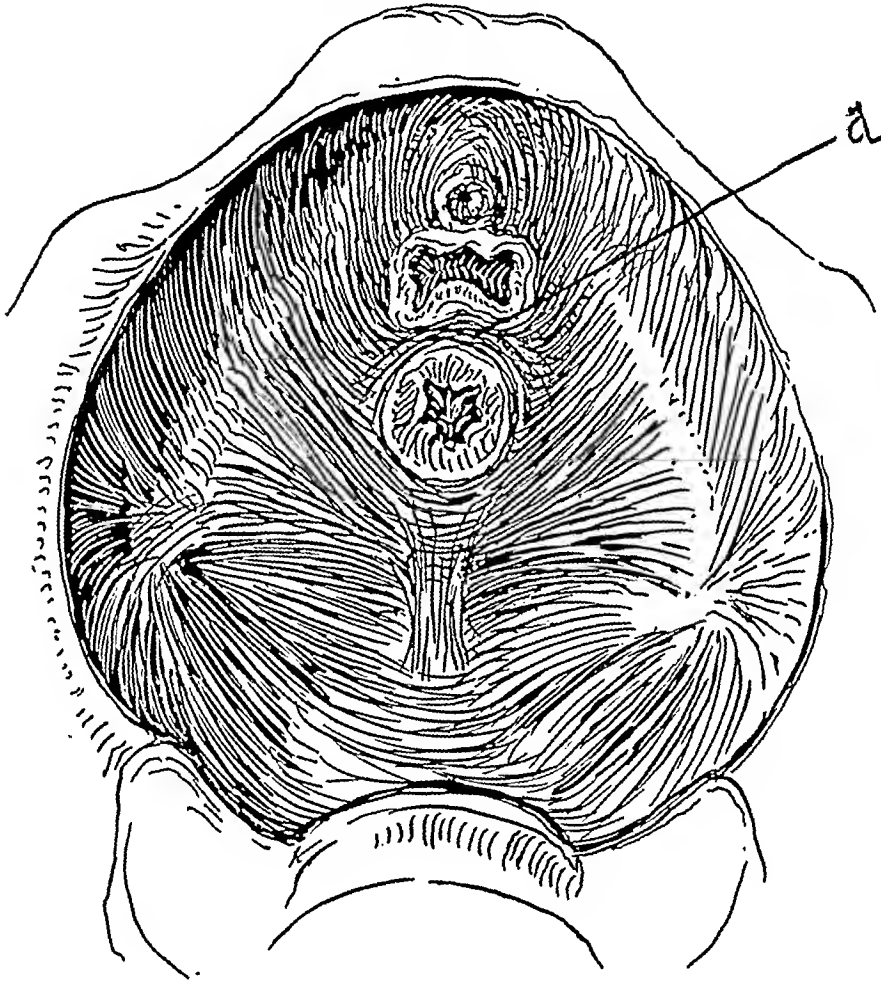


FIG. 219.—SUPERFICIAL DISSECTION PELVIC DIAPHRAGM.

a. Decussation of the most anterior fibers of the levator ani muscle. (Halban and Tandler.)

distinct layers of muscles differing in origin and function. The upper layer forms a broad muscular sheet (levator ani and coccygeus), derived from the flexors and abductors of the caudal end of the vertebral column, with the function of supporting the abdominal viscera (except as noted) and forming the pelvic diaphragm. The inferior layer, derived from the primitive sphincter cloaca, includes the transversus perinei muscles superficialis and profundus, the bulbocavernosus, the ischiocavernosus, and the constrictor urethrae. To these sphincter muscles must be added the fibers of the levator

ani which lie adjacent to the side walls of the vagina and rectum, for when the cloaca existed in embryonic life, the pubococcygeus muscle passed to the outer side of the cloaca, but as the opening closed in to form the anus and vulvar orifices, the fibers of the muscles came together between the two canals and then decussated with those of the opposite side, forming a sphincter muscle.

Diaphragm.—*Pelvic.*—The pelvic diaphragm (Meyer) is a broad muscle-fascia sheet extending across the outlet and closing the floor in the middle portion except where pierced by the urethra, vagina, and rectum, Figure 219. It is composed of two muscles from each side of the pelvis, the levator ani and the ischiococcygeus, the latter forming the posterior portion of the pelvic diaphragm, while the levator ani forms the remaining lateral and anterior portions, except for a short space on the posterior surface of the symphysis pubis. The levator ani is composed of two separate muscles. The external muscle (ileococcygeus) arises from the rami of the pubis, the pelvic fascia, and the “arcus tendineus musculi levatoris ani” as far as the margin of the great sacrosciatic notch; its fibers are inserted into the coccyx and into the anococcygeal raphé. The fibers pass from the two sides and decussate with one another in the space between the anus and coccyx just as the muscles decussate in the thoracic diaphragm. The internal portion of the levator (the “pubococcygeus”) arises from the fascia on the back of the symphysis pubis and the rami of the pubis and from the obturator fascia; the outer and upper third is attached to the coccyx and sacrum, the middle portion (puborectalis) decussates with its fellow from the opposite side to form a sphincter which slings the rectum to the symphysis pubis and is the only portion of the levator ani effective in lifting the rectum, and the muscle-fibers of the innermost third pass beside the vaginal canal, without insertion into the lateral vaginal wall, to join the longitudinal fibers of the rectum and the sphincter ani externus, partly by direct union and partly by decussation with the fibers from the opposite side, in the space separating the anterior surface of the rectum from the posterior surface of the vagina (the “musculotendinous spot,” “perineal body,” “center of the perineum”), Figure 220. The internal portion of the levator ani acts directly upon the anus with its fellow of the opposite side to constrict the vagina. This constrictor action of these muscle fibers on the vagina is of great importance during labor and is especially important in repairing injuries to the pelvic floor when it is essential to reunite these fibers in the median line in case they have been torn apart in delivery.

The levator ani muscle is covered by fascia (“rectovesical” or “fascia supradiaphragmatica” or “visceral layer of the endopelvic fascia”), which completely closes in the pelvic floor except for the openings of urethra, vagina, and rectum. Its lower surface is covered by fascia (“anal” or “fascia infradiaphragmatica”), which extends posteriorly to the anococcygeal raphé. At the free border of the levator ani muscle, as it lies at the outer side of the vaginal canal, the superior fascia of the levator ani muscle unites with the

lower fascia of the levator ani. The two fascias fused now pass directly in front of the rectum to become continuous with the corresponding fascias on the opposite side. An injury to the fascia at this location results in a rectocele, and a repair made for that injury must include suturing of this fascia.

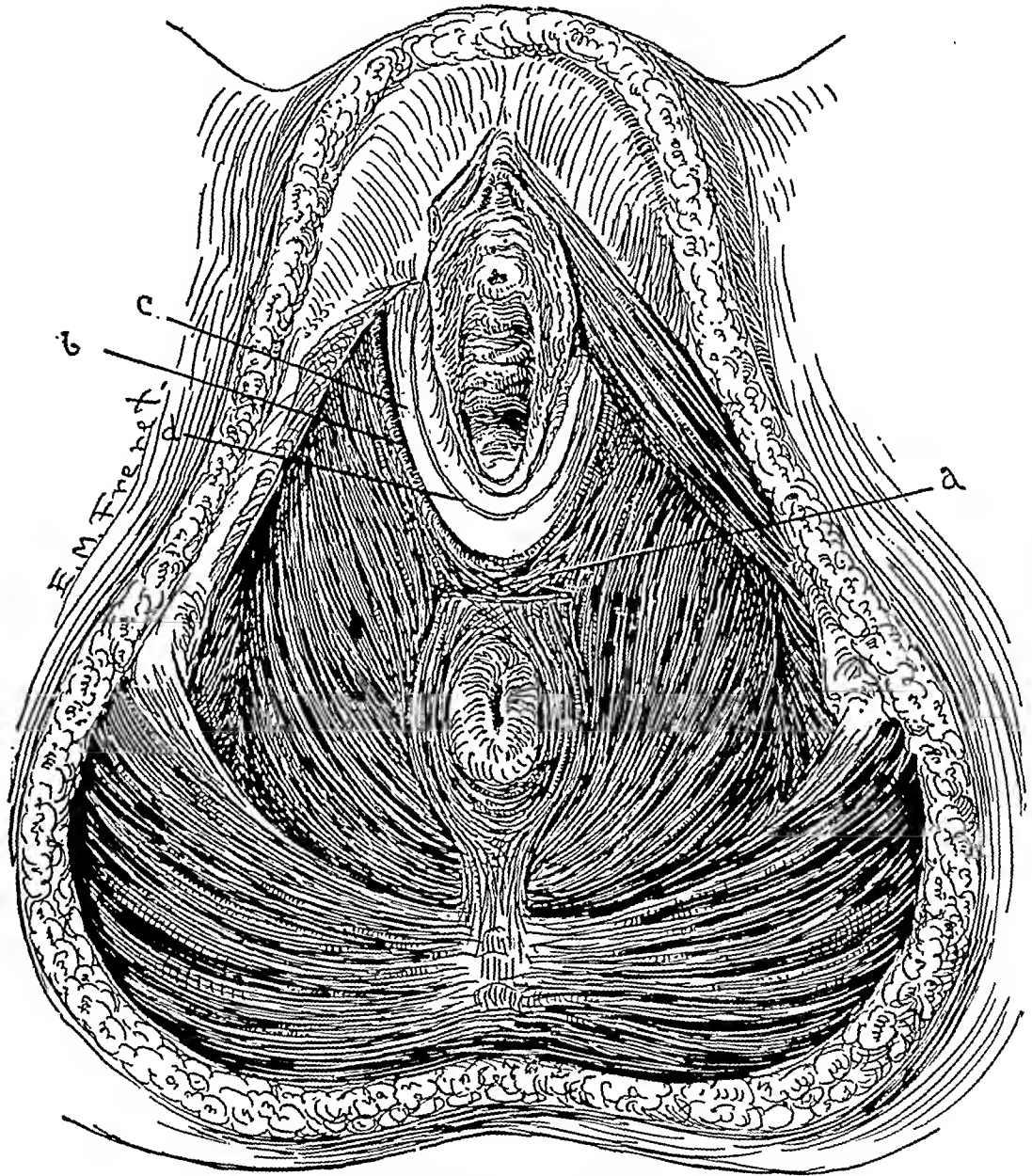


FIG. 220.—DEEPER DISSECTION PELVIC DIAPHRAGM.

- a. Decussation of the anterior fibers of the levator ani muscle in the perineal body.
- b. Rounded edge of the anterior margin of the levator ani muscle.
- c. Rectovesical or endopelvic fascia.
- d. Cut edge of anal fascia which fuses with rectovesical fascia.

(E. Martin.)

Urogenital ("Urogenital Trigone" or "Triangular Ligament").—The urogenital diaphragm is composed of two strong fascial layers attached in front and at the sides to the pubis and ischiopubic rami as far as the

ischial tuberosities and united behind at the free edge, Figure 221. It is pierced by urethra and vagina. Its superior layer is derived from the obturator fascia and is often not separable from the lower fascia covering the levator ani. Between the two fascial layers in the urogenital diaphragm ("superior aponeu-

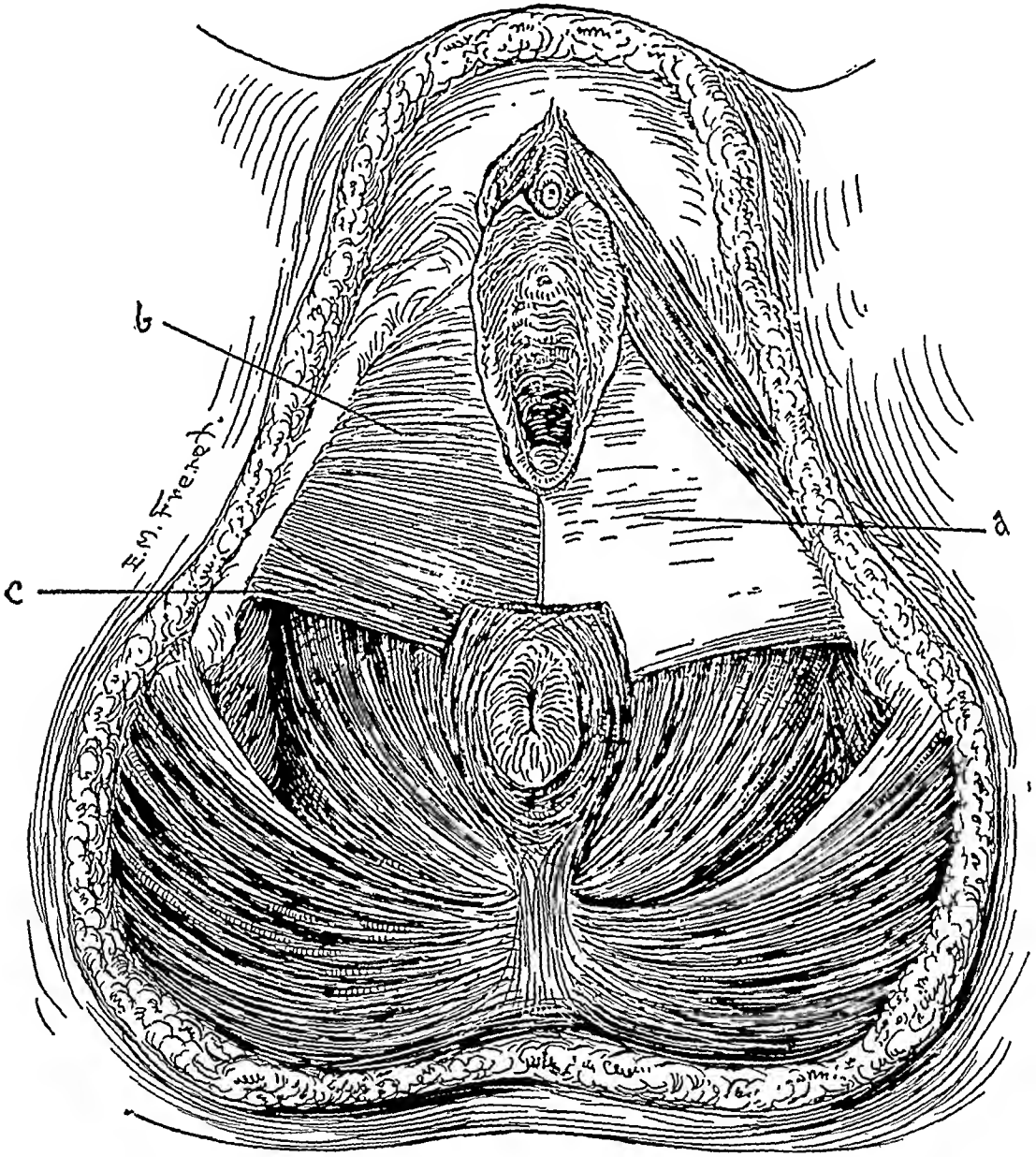


FIG. 221.—ANTERIOR PELVIC DIAPHRAGM REMOVED.

- a. Urogenital diaphragm.
- b. Anterior layer of urogenital diaphragm removed to show membranous urethral muscle.
- c. Deep transversus perineal muscle. (E. Martin.)

rotic space") lie the transversus perinei profundus and the constrictor of the urethra muscles. It is near the posterior free border at the outer one-third of this diaphragm that the retracted or torn edge of the levator ani muscle is usually found. The superficial perineal fascia ("fascia of Colles," or "deep superficial fascia"), the most superficial of the three true perineal fascias,

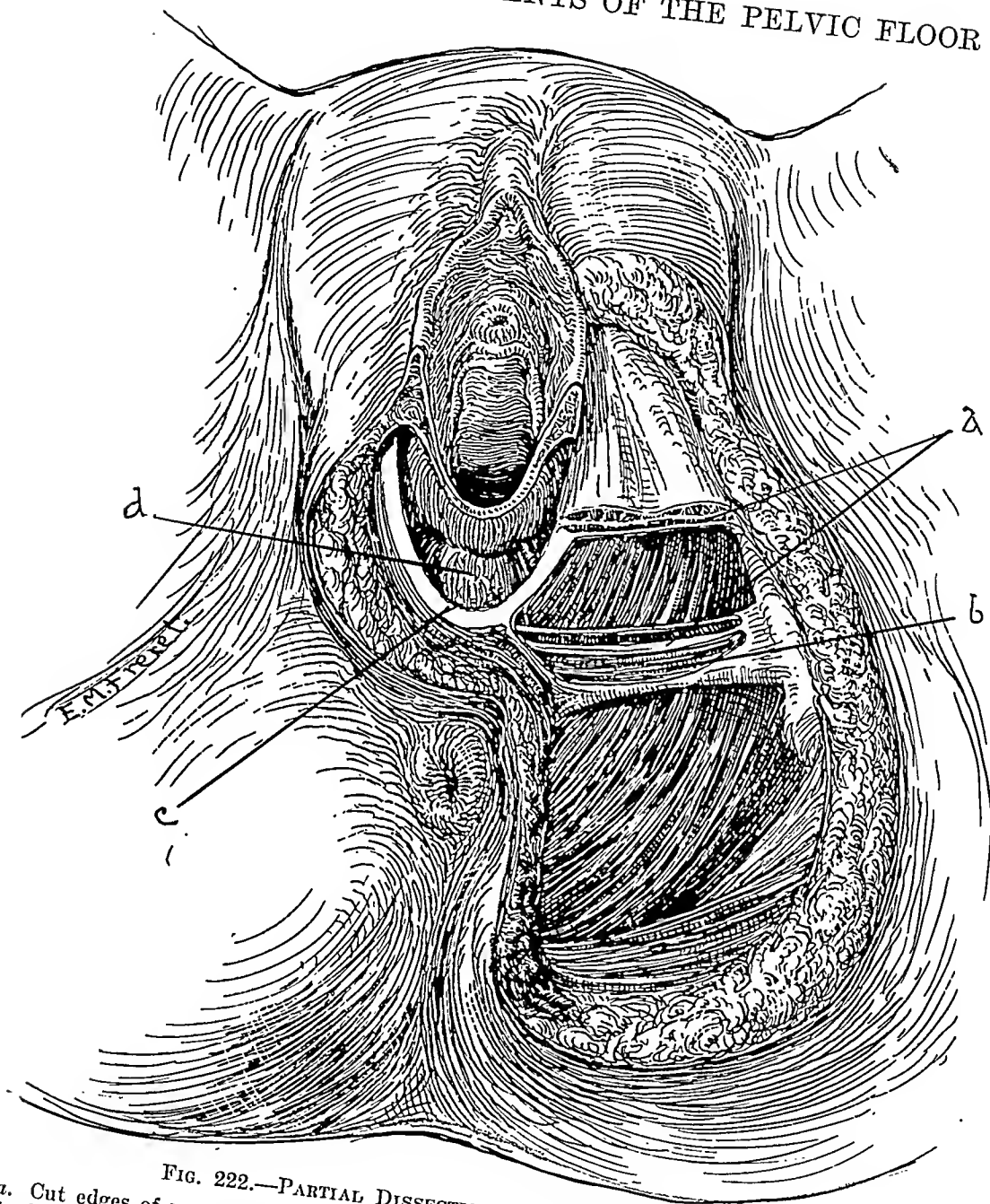


FIG. 222.—PARTIAL DISSECTION OF PELVIC DIAPHRAGM.

- a. Cut edges of urogenital diaphragm.
- b. Deep transverse perineal muscle.
- c. Point of fusion of two layers of fascia above and below the levator ani muscle and the urogenital diaphragm, at the perineal body.
- d. Rectum.

(E. Martin.)

is attached on each side to the ischiopubic ramus as far as the ischial tuberosity and fuses posteriorly with the free border of the urogenital diaphragm. In the space between the superficial fascia and diaphragm (the "superficial perineal interspace" or the "inferior aponeurotic space") lie the bulbs of the vagina, the superficial transversus perinei, the bulbocavernosus, the ischio-cavernosus muscles, and the vulvovaginal glands, Figure 223.

Upper Floor.—Viewing the pelvic floor from above downward, one sees then the pelvic diaphragm extending completely across the outlet, except for the interval between the inner border of levator ani muscles, and the uro-

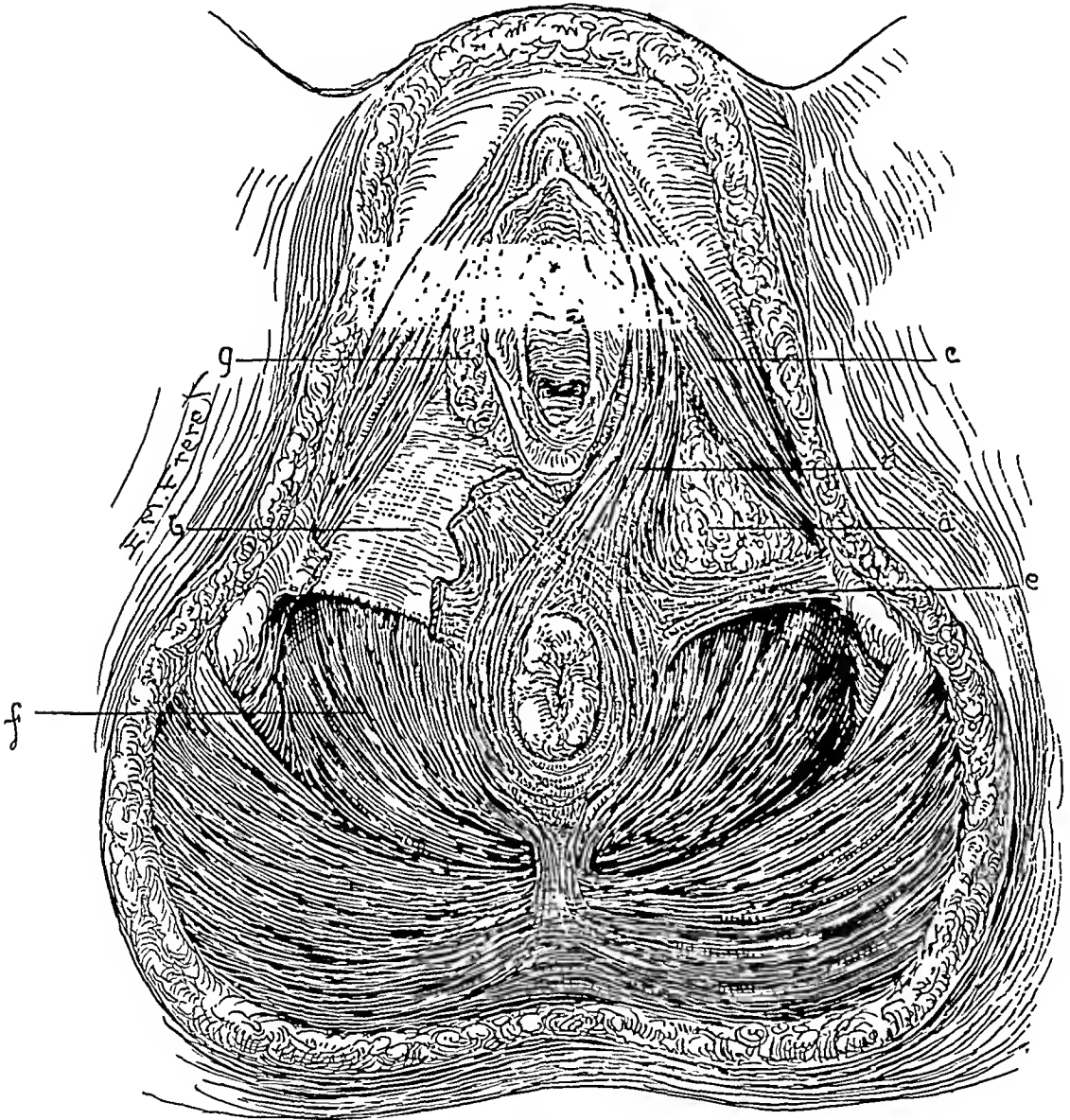


FIG. 223.—SUPERFICIAL LAYERS OF PELVIC DIAPHRAGM REMOVED.

- a. Fat covering urogenital diaphragm.
- b. Urogenital diaphragm with superficial muscles cut away.
- c. Ischio-cavernosus muscle.
- d. Bulbocavernosus muscle covering the vulvovaginal glands.
- e. Superficial transversus perinei muscle.
- f. Levator ani muscle.
- g. Bulbar plexus.

(E. Martin.)

genital diaphragm extending across the anterior half of the outlet. Above the pelvic diaphragm a third plane of tissue lies across the outlet—"the upper pelvic floor" (Polk), or, better, diaphragm, the so-called "cardinal ligament" or "mesometrium," "ligamenta colli transversa" of Mackenrodt, "sustentaculum"

of Bonney, "retinaculum uteri" of Martin, made up of layers of unstriated muscle tissue arising from the obturator fascias and attached to the sides of the uterus, anteriorly inserted into the cervix and posteriorly forming thick muscular bands, the uterosacral ligaments, and recto-uterine muscles.

Cunningham says, "It is probable that during life the uterus is maintained in a normal anteverted and anteflexed position by the fixation of the

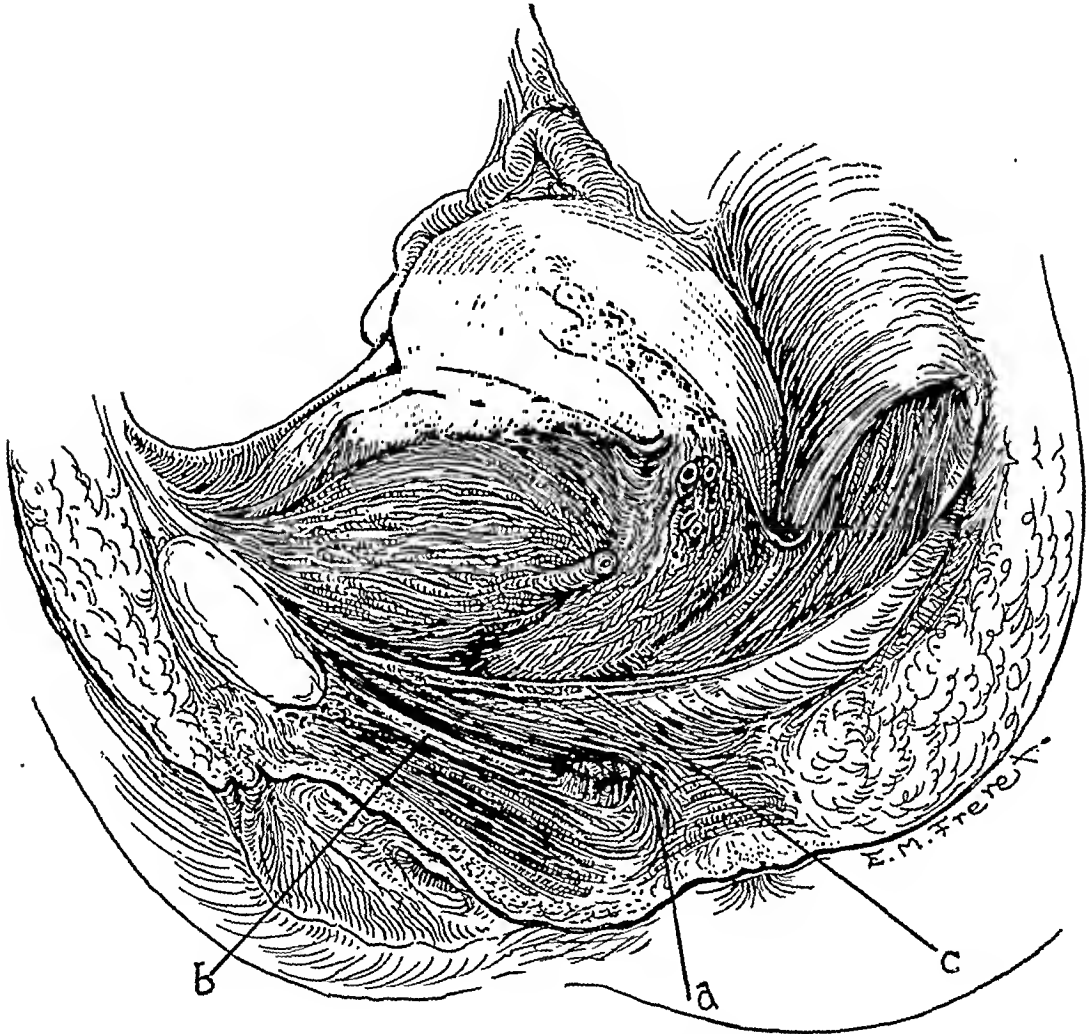


FIG. 224.—SAGITTAL SECTION THROUGH PELVIC FLOOR.

- a. Decussation of the most anterior fibers of the levator ani muscle.
- b. Urogenital diaphragm.
- c. Upper pelvic floor.

(Testut and Jacob.)

cervix at the anterior vaginal wall, and by the pull of the numerous strands of smooth muscle-fibers which form the uterosacrals, the lateral cervical and the round ligaments."

Just below the attachment of these fibers into the cervix is the endopelvic fascial plane; in this way the uterus rests on a superior diaphragm of muscle and fascia which completely closes the upper portion of the pelvic floor except for the gap posteriorly between the uterosacrals where there

is a firm fascia over the vaginal vault. It is further supported by the pelvic and urogenital diaphragms below. The importance of the upper diaphragm is seen in the illustration, Figure 224. The diaphragms of the

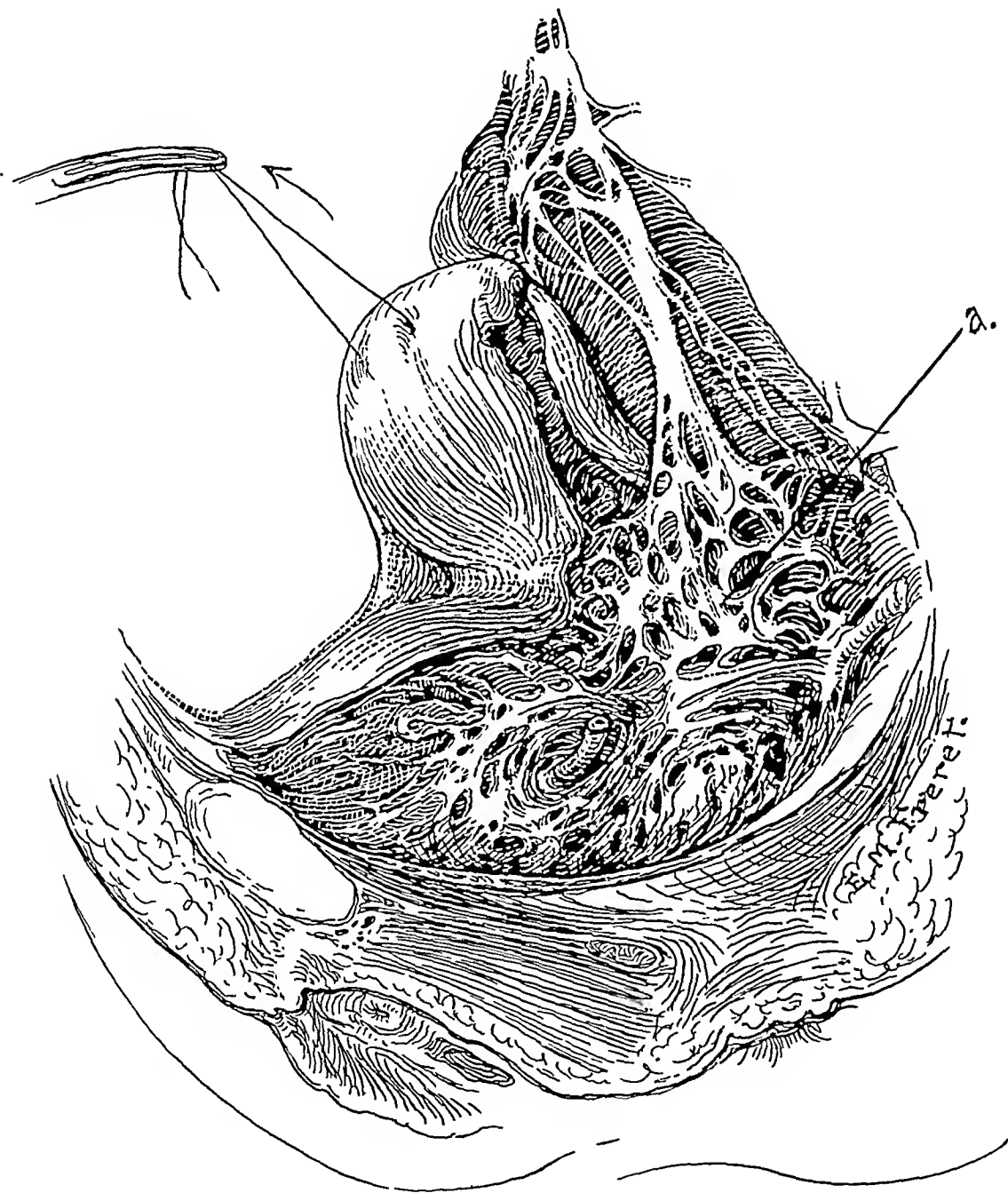


FIG. 225.—CONNECTIVE TISSUE AND GANGLIA OF CERVIX UTERI (*a*).

Endopelvic fascia surrounding blood-vessels. (Savage.)

pelvic floor extend across the pelvis and are, as it were, cemented together by the network of connective tissue and muscle in and around blood-vessels and nerves, Figure 225. To this support we must add the pelvic fat which acts

as a buffer to the tissues and the absorption of which in the aged is a contributing factor in prolapse. "The ischiorectal pad supporting the levator ani below affords an additional support to the pelvic floor owing to the

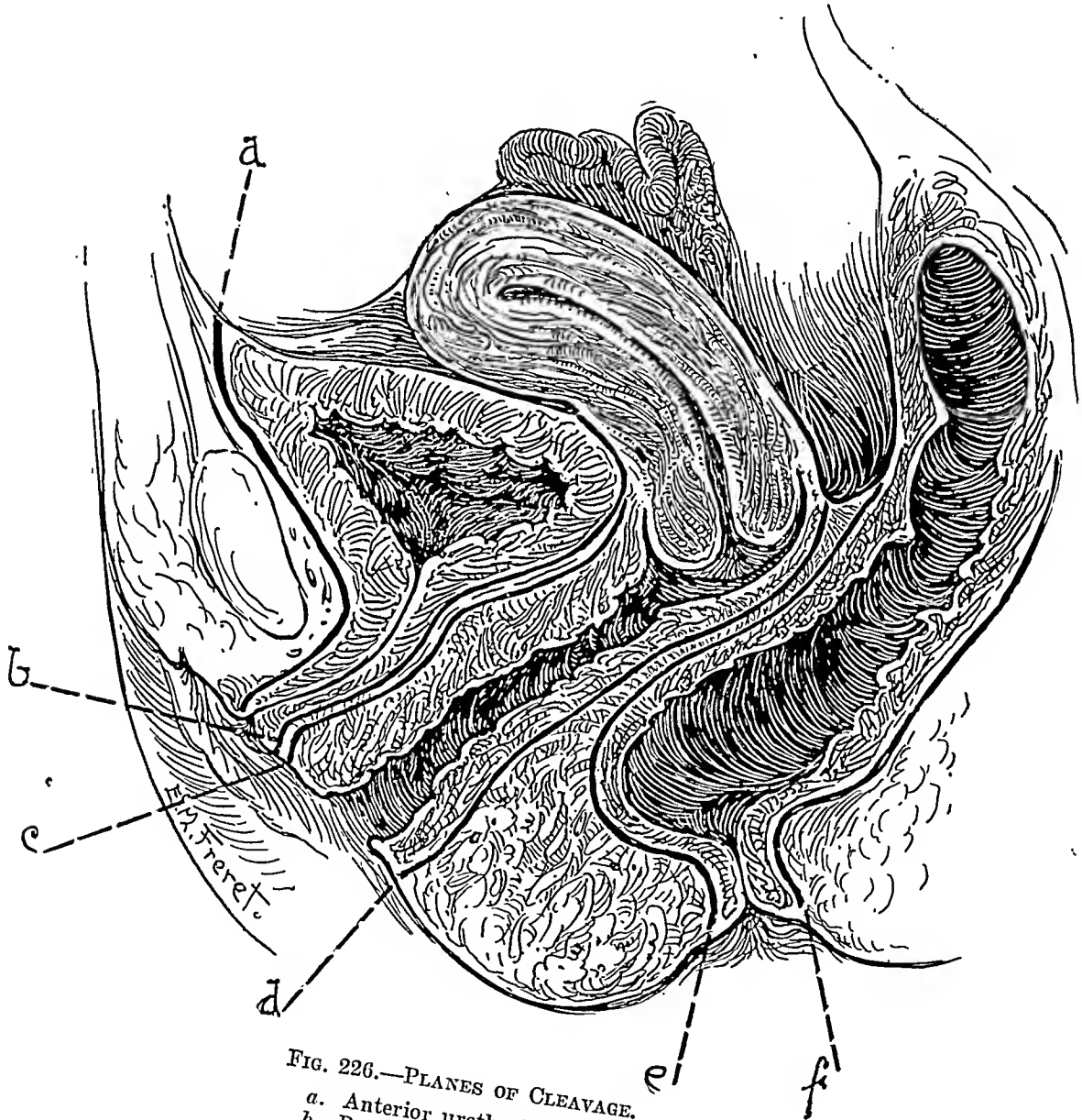


FIG. 226.—PLANES OF CLEAVAGE.

- a. Anterior urethral plane.
- b. Posterior urethral plane.
- c. Anterior vaginal plane.
- d. Posterior vaginal plane.
- e. Anterior rectal plane.
- f. Posterior rectal plane.

(R. L. Dickinson.)

fact that it in turn is supported by the great sciatic ligament and the thick margin of the gluteus maximus muscles which overhangs the ligament" (Morrill).

Injuries.—*Directly Concerned with Cleavage Lines.*—Looking at the pelvis from before backward, one sees the three canals—urethra, vagina, and rectum—penetrating the pelvic floor at different levels, the rectum alone of the three being firmly attached to muscle or fascia. Viewed in this way the canals are

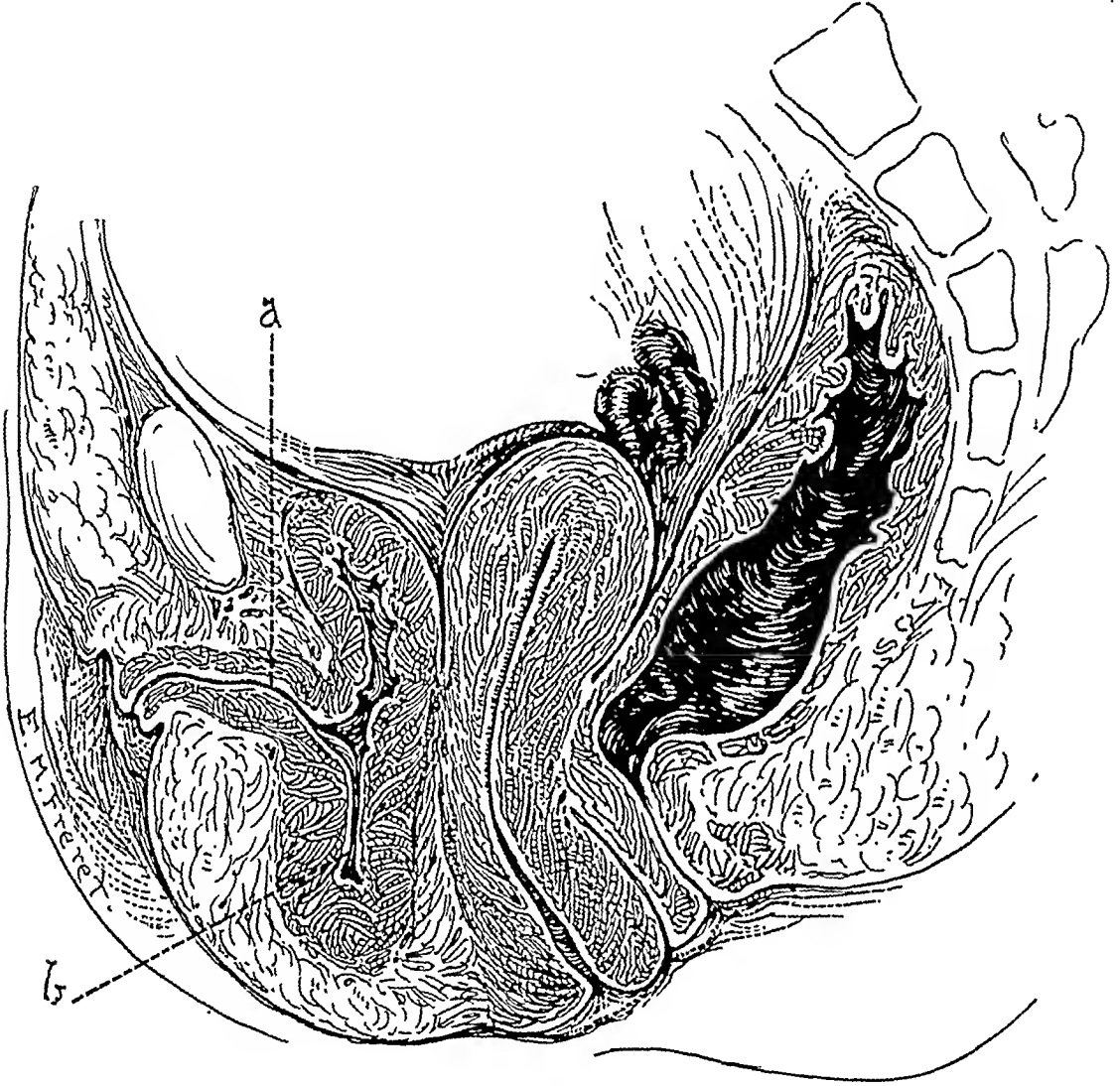


FIG. 227.—SAGITTAL SECTION THROUGH PELVIS, SHOWING PROLAPSED UTERUS AND BLADDER.

- a. Urethra torn from pubic attachment.
- b. Cystocele.

(Halban and Tandler.)

connecting planes between the diaphragms or lines of cleavage down which a hernia may glide (R. L. Dickinson), Figure 226.

An injury may affect any of the segments singly or several at the same time, usually the anterior vaginal wall, the least supported of the three, with urethra, bladder, and cervix all attached here. Prolapse of the uterus occurs only with extensive injury of the supporting structures of the muscle-fascia diaphragms of the pelvic floor.

Urethrocele.—The urethra is attached to the posterior surface of the pubic bone, to the subpubic fascia, and to the anterior vaginal wall. When torn from these attachments, the urethra must be sutured to the fascia or periosteum of the pubic bone, Figure 227. The commonest injury to the lower surface of the urethra is repaired by reefing the muscle or repairing the fascia of the urogenital diaphragm.

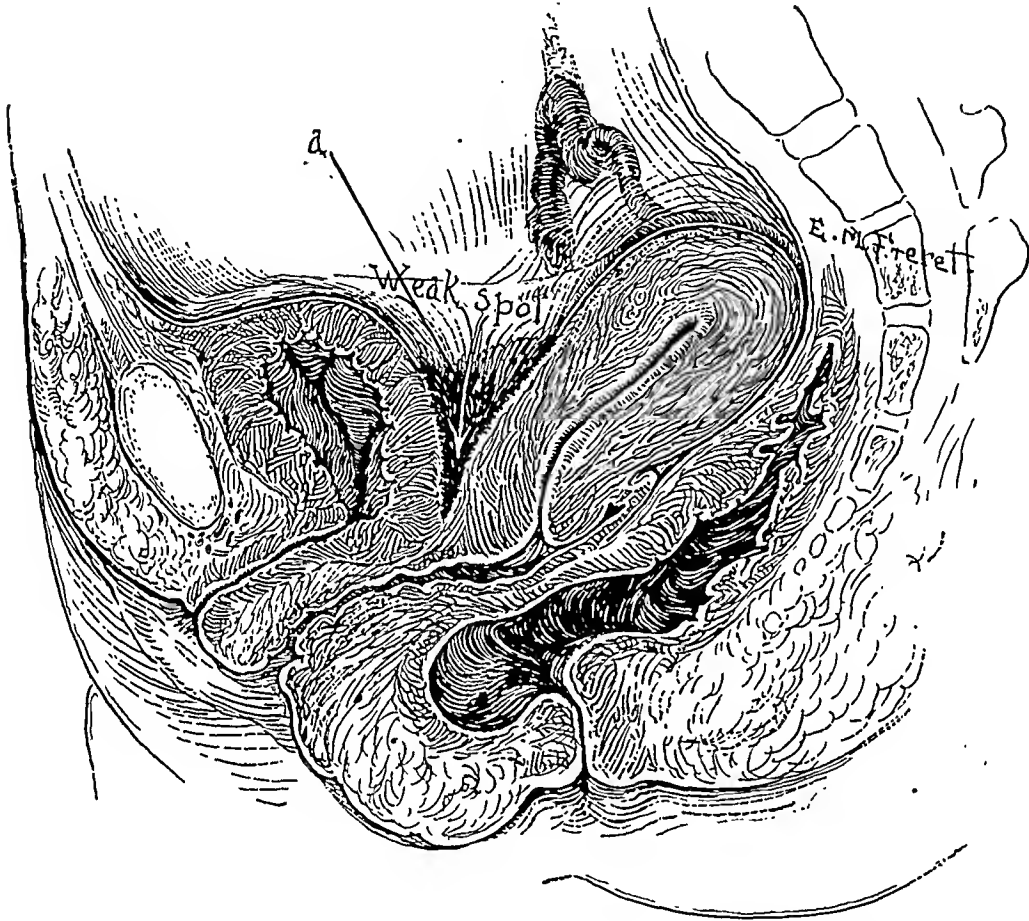


FIG. 228.—SEPARATION OF BLADDER FROM ANTERIOR WALL OF UTERUS—"WEAK SPOT" (a).
(Halban and Tandler.)

Cystocele (Hernia of the Bladder).—The bladder is supported below by:

1. The vesical fascia, a fibrous structure especially strong under the lower half of the bladder.
2. The uteropubic fascial plane, attached anteriorly to the back of the symphysis pubis.
3. The muscle-fibers of the cardinal ligament, inserted into the anterior surface of the cervix.
4. The pubovesical muscle, extending from the posterior part of the anterior surface of the bladder to the pubis, while other strands pass in the

peritoneal folds which bound the rectovesical pouch from the rectum to the posterior wall of the bladder, forming the rectovaginal muscles (McMurrich).

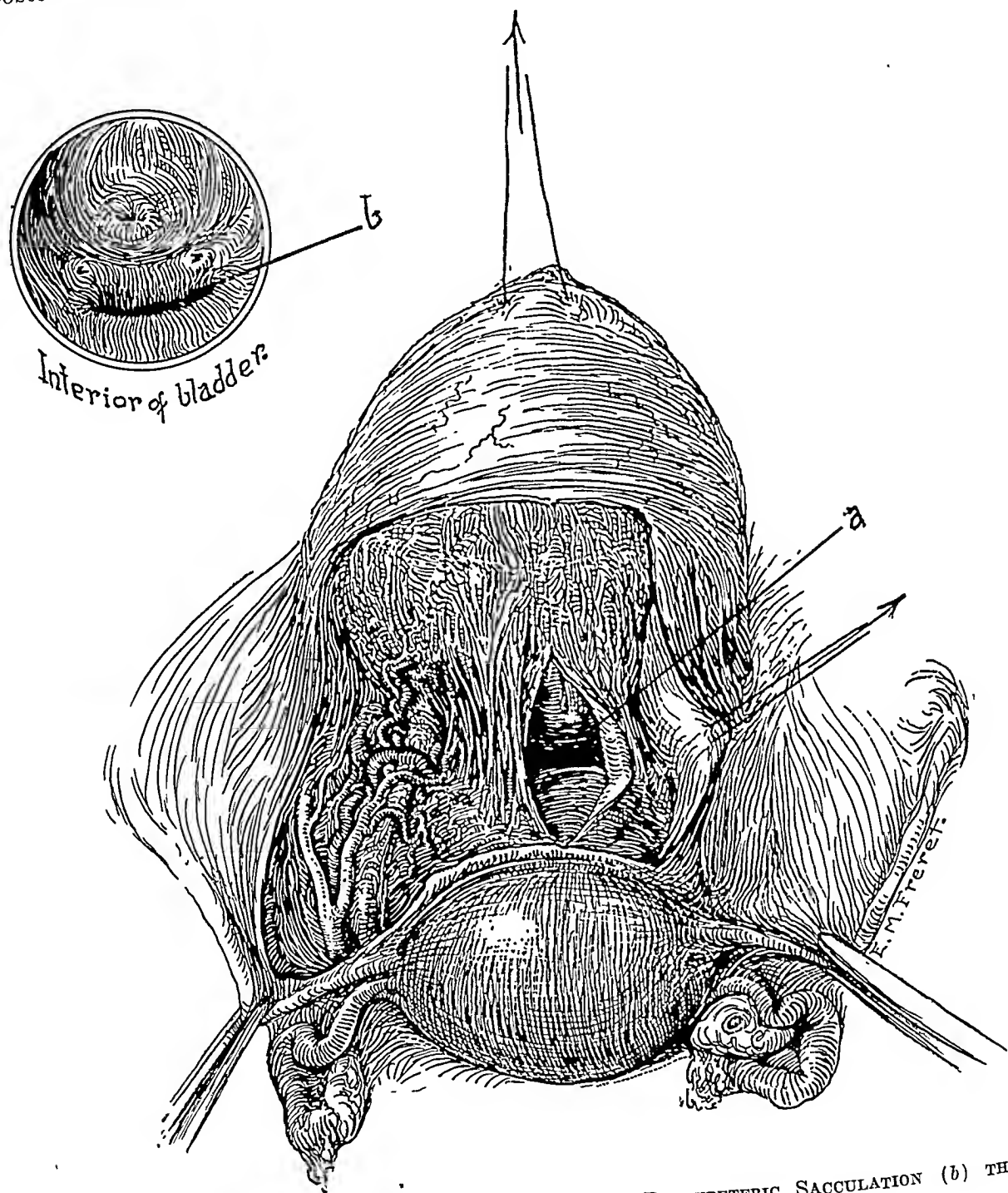


FIG. 229.—RENT IN UTEROVESICAL FASCIA (a) AND POSTURETERIC SACCULATION (b) THE RESULT OF a. (E. Martin.)

5. The direct attachment to the anterior surface of the uterus; the tearing away of the attachment, Figure 228, or the splitting of the uteropubic fascial plane, Figure 229, allowing the postureteric space to sag and a sacculation to

develop with elongation, not only of the bladder wall but prolapse of the ureters as well, Figure 230.

To repair a cystocele it is necessary first to free the bladder, Figure 237, from its attachments to fascia and vagina and carry it back as in a hernia



FIG. 230.—PROLAPSED URETER AND CYSTOCELE (a).
(Halban and Tandler.)

operation to its original site or even higher on the anterior surface of the uterus, otherwise a space is left for residual urine and there is no supporting tissue below the bladder. The fascia must be repaired anterior to the bladder to insure support and the muscles of the cardinal ligaments shortened at the cervix, if a descensus of the uterus makes this advisable. Cystocele may occur without prolapse of the uterus or may accompany a prolapsed uterus, Figure 227, while the bladder is still attached to the anterior surface of the uterus.

R e c t o c e l e (Hernia of the Rectum).—This lesion results from a rent in the levator fascia lying in front of the rectum. The fascia in this location is double, consisting as it does of the two layers of levator fascia which have coalesced and bridged the levator gap and then crossed over to join the levator of the opposite side. The rectum must be freed, pushed upward, and the rent in the fascia closed. Repair of the perineum is also included under pro-

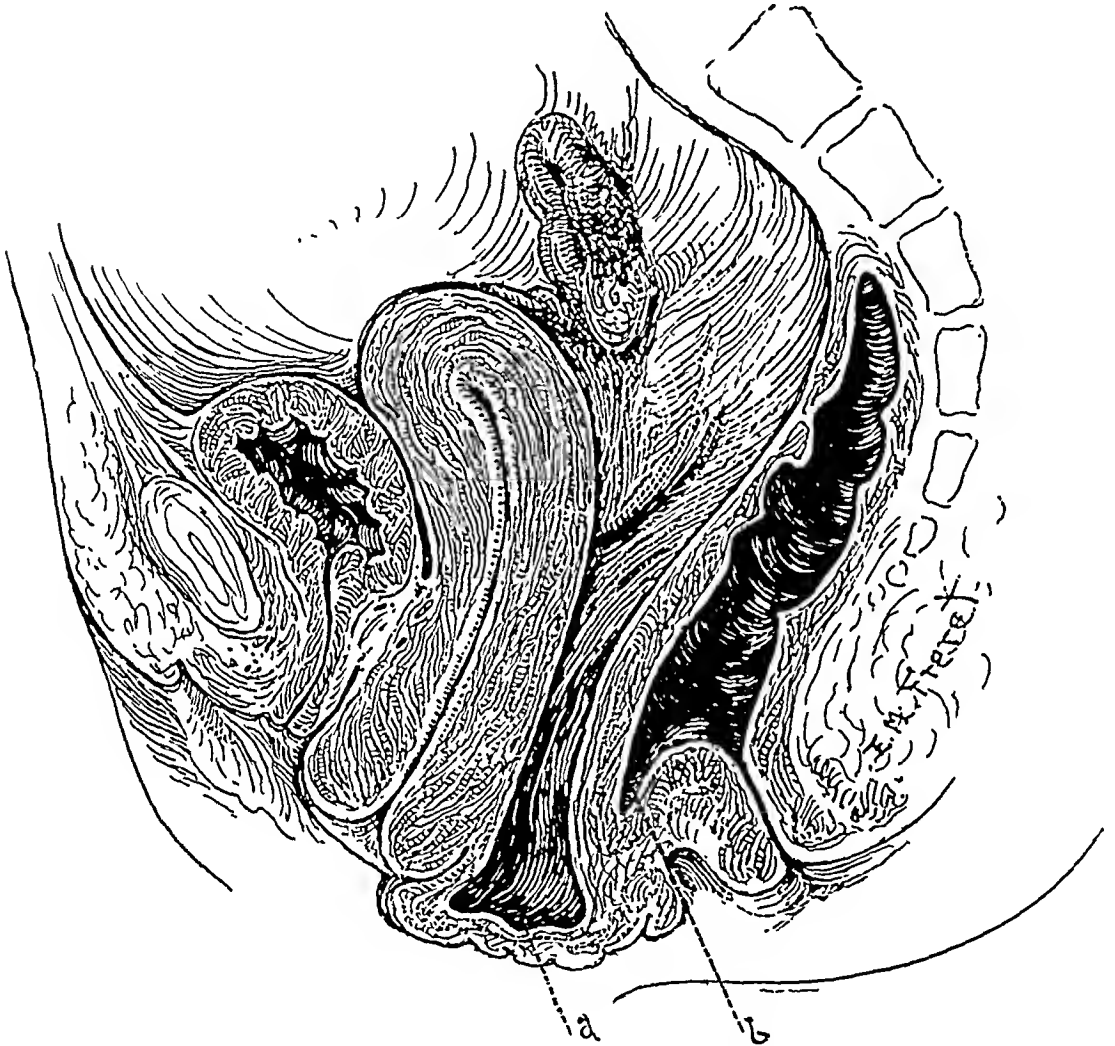


FIG. 231.—COMPLETE PROLAPUS OF POSTERIOR PELVIC FLOOR.

- a. Enterocoele.
- b. Rectocoele.

(Halban and Tandler.)

lapse, as the laceration of the perineum is an injury to the urogenital and pelvic diaphragms.

E n t e r o c e l e (High Rectocoele, or Hernia of Douglas).—The formation of a hernia in this location, Figure 231, is due to a tearing of the fascia over the vault of the vagina or to an elongation or atrophy of the uterosacral and rectosacral muscles or to both. The condition is occasionally seen alone or with a rectocoele; it often accompanies prolapse of the uterus. Its repair

involves dissecting out of the hernial sac, closure of the rent in the fascia, and the reunion of the muscles of the uterosacral and rectosacral ligaments.

Urethrocele, rectocele, cystocele, and enterocele, all partake essentially of the nature of true hernias, a viscus torn away from the underlying plane supporting it and descended or displaced to a level lower than that plane. The essential principle of the repair is the return of the displaced organ to its original position, just as with hernias elsewhere, including the repair of the damaged supporting tissues, by suturing muscle to muscle and fascia to fascia, by layer and not by mass suture, so that the muscle regains its full play and recovers its normal tonus.

Chiefly Concerned with Diaphragms.—*Laceration of Cervix.*—It is unfortunate that the Emmet trachelorrhaphy has fallen so completely into disuse, as local treatment cannot take the place of needed repair, and too often the high amputation of the cervix destroys the balance of the uterus by injuring the attachments of the cardinal ligaments to the cervix, allowing the muscles of the uterosacral ligaments to displace the uterus backwards.

Laceration of Perineum.—Any considerable injury to the perineum means a laceration of the perineal fascias—deep superficial, the urogenital diaphragm, the levator fascia, and the anterior fibers of the levator ani (the “pubococcygeus”) with consequent retraction of the muscle; if the laceration is of long standing, there is always some atrophy of its fibers from disuse. If a rectocele exists this should first be restored, followed by the suture of the torn tissues layer by layer. The edges of the levator ani should be exposed and joined by suture at the central tendinous spot from which they were divulsed. The perineum should then be closed by layer and not by mass suture, by reuniting the torn edges of the urogenital diaphragm, perineal fascia, and lastly mucous membrane and skin.

Prolapse of Uterus.—The condition of prolapse differs greatly from injuries concerned with cleavage lines. The uterus is held by lateral-posterior-anterior attachments to the cervix by muscles and fascia, suspended and drawn upward and backward by the uterosacral muscles. It is drawn forward by the muscular round ligaments and, equally important, is supported from below by a strong muscle-fascia diaphragm. The intra-abdominal pressure and counter-pressure of the viscera influence the position somewhat, it is true, but, nevertheless, muscle aided by fascia holds and supports the uterus. Overstretched or torn muscle must be reefed or sutured to its old attachment that the muscle may regain its tone, for *muscle will always work*, and if the thin attenuated elongated muscle is only properly shortened and given a fixed point from which to work with adequate fascial support, it will renew its function. Not only does the tone of the muscle depend upon its own activity but the supporting power of the fascia also depends upon it; with hypertrophy of the muscle comes increase in blood supply, better nutrition, and stimulation of connective-tissue cells. “In the case of the limbs the state of the development

of the fascial sheaths of muscle depends, as mentioned, on the functional activity of the muscles concerned. Similarly the fascial lining of the pelvic floor is dependent on the activity of its associated musculature" (Paramore). It is important, therefore, to shorten and secure overstretched or torn muscles by layer and not by mass suture, in order to give full play to the reunited muscle-fibers.

In an incipient uterine descensus or retroversion, the taking up of the slack of the muscle in the cervix (Alexandroff's stitch), or in the uterosacrals, with the shortening of the round ligaments, together with a repair of the pelvic floor, is sufficient to cure the condition. In more advanced prolapses, the degree of stretching of the muscle, the condition of the prolapsed organs, and the age of the patient must determine the type of operation.

If the uterosacral muscles and the cardinal ligaments are not greatly overstretched and the uterus is free from myomata, an operation of the Watkins-Wertheim type will suffice. This completed operation should suspend the uterus as a bridge exactly across the distance, with the round ligaments attached anteriorly to the pubic periosteum and the now taut uterosacral ligaments holding it posteriorly.

In a second or third degree prolapse, the cardinal ligaments are so overstretched that an operation of the Mayo type is advisable, provided the uterus can be sacrificed. The cardinal ligaments are overlapped until all slack is taken up, the round ligaments are sewn to the periosteum of the pubic bone, and the uterosacrals are fastened to the already reefed muscles above. The success of the operation does not depend upon the size of the platform thus made nor upon the thickness of the overlapped tissue, but upon the proper shortening of the muscles in the cardinal ligaments and the attachment of the muscles in the round and uterosacral ligaments.

The perineum should always be repaired in prolapse in order to correct injuries to the pelvic and to the urogenital diaphragms.

CHAPTER XIX
CYSTOCELE AND PROLAPSUS UTERI
GEORGE GRAY WARD

HISTORY

ANATOMY

REPAIR

A. Childbearing Women

B. Nonchildbearing Women

MODIFIED WATKINS OPERATION

MODIFIED MAYO OPERATION FOR COMPLETE PROCIDENTIA

C. Farrar Operation for Large Cystocele Associated with Myomatous Uteri

History.—To Hadra (*Lesions of the Vagina and Pelvic Floor*; *Am. J. Obst.*, 1889, 22) and Säger (*Centralb. f. Gynäk.*, 1892, 16) belongs the credit for the development of the modern operation for the care of cystocele and prolapse.

The history of cystocele has been reviewed recently and brought up to date in an article with over one hundred references by Rawls (*Am. J. Obst.*, 1918, 77, 78), and also in an article by Farrar (*Am. J. Obst. & Gynec.*, 1921, 2).

The operative technique employed to-day varies from a simple denudation of the vaginal mucosa with approximation of the margins with sutures, to the most extensive bladder dissection with invasion of the abdominal cavity.

Simple denudation and approximation are only used to remove hyperrophied and redundant tissue often present in the lower vagina from exposure, and have no place in the cure of cystocele.

Sims (*Clinical Notes on Uterine Surgery*, 1871) was the first completely to expose the base of the bladder as is done to-day, although he abandoned it later for his V-shaped denudation. It is interesting to note that he did it accidentally while attempting to cure a cystocele by the very radical plan of clamping off the vaginal wall and the base of the bladder and cutting them away, intending to close the resulting vesicovaginal fistula by his classical technique. To his surprise, he found that he had not only removed the vaginal tissue but had also completely exposed the bladder base. He then sutured the vaginal walls together. This resection of the vaginal wall only corrects the injury of the transverse stretching and thinning in the median line, and, therefore, frequently does not give satisfactory permanent results.

The Emmet operation (*Am. Gynec. & Obst. J.*, 1900, 16) and its modifica-

tion by Baldwin (*N. York M. J.*, 1912, 96) depends upon the denudation exposing the firm tissue of the base of the broad ligaments on each side of the cervix, which areas are then approximated in front of that organ, throwing it backward and elevating the uterus and placing a firm buttress or support in front of it over the "weak spot" hereafter mentioned.

The operation of Reynolds (*Am. Med.*, 1902, 4) depends on the same principle. These operations correct the tendency to prolapse of the uterus by reefing the elongated broad ligaments and anteverting the uterus by throwing back the cervix, and they reinforce the weakened area in front of the cervix and midline, but in no way attempt directly to replace the overstretched bladder. At most they close the door of escape without first reducing the hernia, the overstretched base of which must necessarily be thrown into puckers or folds; they do not restore the anterior vaginal wall to its normal attachment to the cervix.

Hirst (*Am. J. Obst.*, 1902, 45; 1905, 53), believing that the injury in cystocele was due to tears in the anterior vaginal sulci of the urogenital trigonum, advocated triangular denudation in the anterior sulci with suture, combined with a central colporrhaphy.

To Hadra belongs the credit of first calling attention to the necessity of elevating the bladder and restoring the normal invagination of the cervix by reattaching the vaginal wall high up on that organ. Sanger and Noble (Kelly-Noble, *Gynecology and Abdominal Surgery*, 1907), following the same lines perfected the technique, their operation marking an advance although not providing for the correction of any associated uterine prolapse.

Goffe (*J. Am. M. Ass.*, 1902, 39; *Northwest. Med.*, 1905, 3; *Tr. N. York Obst. Soc.*, 1906; *Med. Rec.*, 1912, 82) evolved a more radical operation of elevating the bladder in the pelvis, based on the principle of suspension. His operation of a wide, free dissection of the bladder from the entire vaginal wall and uterus, opening into the peritoneal cavity with the suturing of the bladder high up on the body of the uterus and broad ligaments, is well known. He recognized that the only way of eliminating the redundancy and increased length of the bladder wall at its base, due to the overstretching, was to free it sufficiently to enable it to be rotated upward on its transverse axis, and to dispose of the excess higher up in the pelvis. This operation is generally satisfactory in its results but requires extensive and usually unnecessary dissection. The technique does not restore the invagination of the cervix, nor dispose of the lengthened vaginal wall.

Recently much attention has been directed to the importance of the uteropubic fascial ligament, the so-called bladder pillars, in the repair of cystocele. August Martin's book (*Der Haftapparat der weiblichen Genitalien*, 1911), with splendid illustrations of these fascial ligaments, although somewhat exaggerated, and the excellent monograph of Frank have emphasized them as an important factor to be considered in the cure of cystocele. In the usual dis-

section, these tissues of the uteropubic fascial plane remain attached to the bladder wall and in many operations are merely pliated by turning in and suturing this apparently thickened bladder base, which must result in puckering and folding viscus. Rawls has advocated their thorough dissection and overlapping by mattress-sutures. Bissell (Case History No. 7546, *Woman's Hospital Records; Am. J. Obst.*, 1918, 77, 78; *Surg., Gynec., & Obst.*, 1919, 28; *Tr. Am. Gyn. Soc.*, 1918, 43) has devised a technique of overlapping the vaginal wall with its attached fascia and securing it with mattress-sutures, to produce the required support for the bladder.

The technique described by Frank (*Surg., Gynec., & Obst.*, 1917, 24) and Rawls endeavors to meet the requirements of elevation of the bladder and reattachment of the tissues to the cervix, restoring the invagination, as well as of utilizing the fascial support of the uteropubic ligaments to strengthen the so-called weak spot, but does not attempt to correct prolapse of the uterus, or to antevert that organ.

The operation of wide dissection and overlapping of this fascia may be criticized as practically too complicated and tedious. The elaborate dissection of the fascia with the complexity of the suturing takes up too much time with insufficient gain, especially as it must be combined with additional operative measures.

The operation of overlapping the vaginal wall with its attached fascia is likewise complicated.

We do not believe that an operation depending chiefly upon the transverse shortening of the overstretched fascial fibers and vaginal wall can be relied upon to cure cystocele, especially when it must stand the test of childbearing. The anteroposterior correction of the descent and elongation of the tissues is in our estimation of far greater importance.

Many other operations have had a variable popularity such as those of Stoltz, Dudley, Doleris, Chaput, and Polk, but, as Frank has said, the majority of the operations devised for cystocele depend rather upon ingenious denudations and complicated applications of sutures, than upon a firm anatomical basis. We would also add, that they fail to recognize the multiplicity of the injuries and the resulting changes in the tissues concerned.

Cystocele and prolapsus uteri are best considered together because the two conditions are usually associated in varying ratios. Cystocele alone, however, is met, although less frequently. Prolapsus uteri in any degree is usually accompanied by descent or sagging of the bladder due to its close attachment to the anterior uterine wall. Where prolapse exists the technique to be employed must correct that condition, or whatever operative procedure we employ to the cystocele itself will prove unsatisfactory. True cystocele implies an injury to the fascial supports at the base of the bladder and urethra which results in a vesical or vesico-urethral hernia.

It must be recognized that a sagging of the anterior vaginal wall with the

bladder may result from a prolapse of the uterus without a fascial injury at the base of the bladder. An hypertrophy of the vaginal mucosa, the result of exposure, associated with marked relaxation of the pelvic floor, may give the appearance of a cystocele, but a careful examination will show that the protrusion is one of redundant tissue only. Prolapse of the uterus is frequently associated with elongation of the cervix, a point to be borne in mind in estimating the exact degree of prolapse.

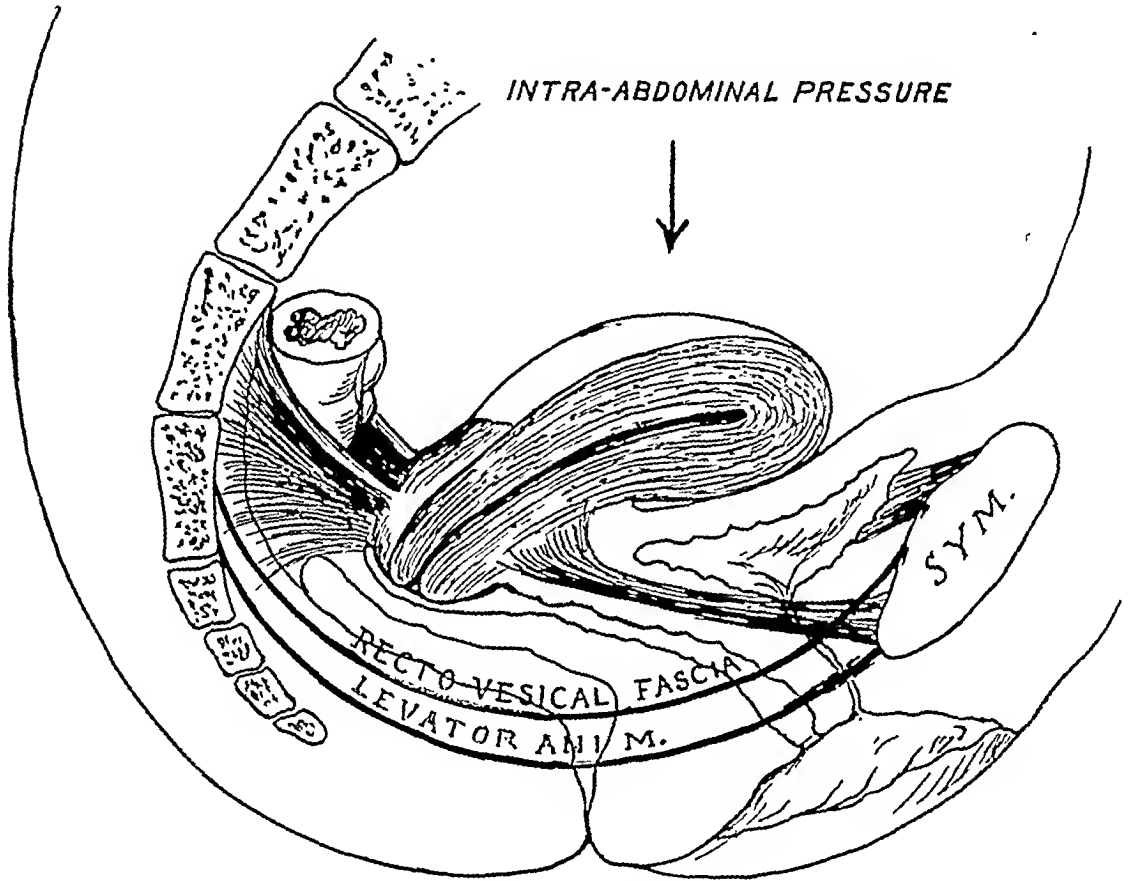


FIG. 232.—RELATION OF UTERUS AND BLADDER IN NORMAL POSITION.

Anteroposterior fascial sling formed by uterosacral ligaments posteriorly, and uteropubic fascial plane anteriorly. Note deflection of intra-abdominal pressure by posterior surface of uterus and protection of bladder from this pressure. (Crossen.)

Anatomy.—To apply intelligently the proper operative procedures to correct injuries of the pelvic structures which result in the various hernial protrusions such as cystocele, rectocele, enterocele, prolapsus uteri, and impaired pelvic floor function, it is essential to have an accurate appreciation of the injuries causing these complications. Basic to this is a correct conception of the anatomical supports and their interrelations that we may understand the exact nature of the damage we propose to repair. It is necessary for a proper understanding of these problems, first to become familiar with the essential surgical anatomy of these parts as detailed in the preceding chapter; it is upon the anatomical conceptions there presented that we have based

the technique illustrated in these chapters, which we have used long enough to prove the soundness of the principles involved.

The bladder may be said to be held in place by anatomical structures working on opposite principles—the supporting apparatus, the uteropubic fascial plane and the anterior vaginal wall with the accessory aid of the posterior segment of the pelvic floor, and the suspending apparatus, the ligaments and connective tissue, suspending or holding the organ by attachments to the uterus and the pelvic structures. Both muscular and fascial apparatus play reciprocal rôles in maintaining the bladder *in situ*, and the injury which causes these supports to fail in their function may be located in different parts or in

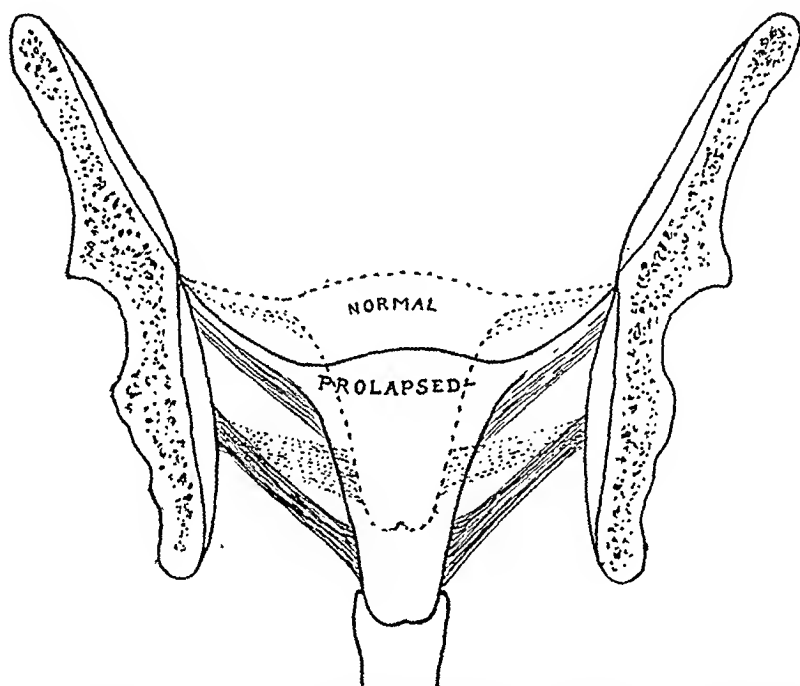


FIG. 233.—DOTTED LINES SHOW UTERUS AND CARDINAL LIGAMENTS IN NORMAL RELATION, SHADED LINES ELONGATED OVERSTRETCHED CARDINAL LIGAMENTS WHEN UTERUS IS PROLAPSED.

several parts of these structures, so whatever operative procedures we may employ for the correction of the injury should be applicable to all the parts that have been damaged. The mistake is often made of utilizing one general operation for all classes of cystocele instead of individualizing and adapting the operation to the particular case.

Reynolds has pointed out that it is important for us to bear in mind that the anterior vaginal wall has two fixed points of attachment—to the cervix and bases of the broad ligaments and to the posterior surface of the pubes. The pubic attachment of the vagina is very firm and practically never yields. Unfortunately the same is not true of the upper point. We know that the chief supports of the uterus, which are the bases of the broad ligaments (the so-called cardinal ligaments, sometimes called Mackenrodt's ligaments) and the

uterosaeral ligaments, stretch and thus fail to support the organ, and as an inevitable consequence a concomitant prolapse of the bladder occurs.

These structures contain involuntary muscle-fibers and through injury or overstretching they cannot contract properly and therefore fail in their function due to atrophy from inaction. When restored to their normal condition they are at once put to work and develop as elsewhere by use.

In another class, failure of the uterine supports is not the primary lesion, but the attachment of the anterior vaginal wall to the upper portion of the

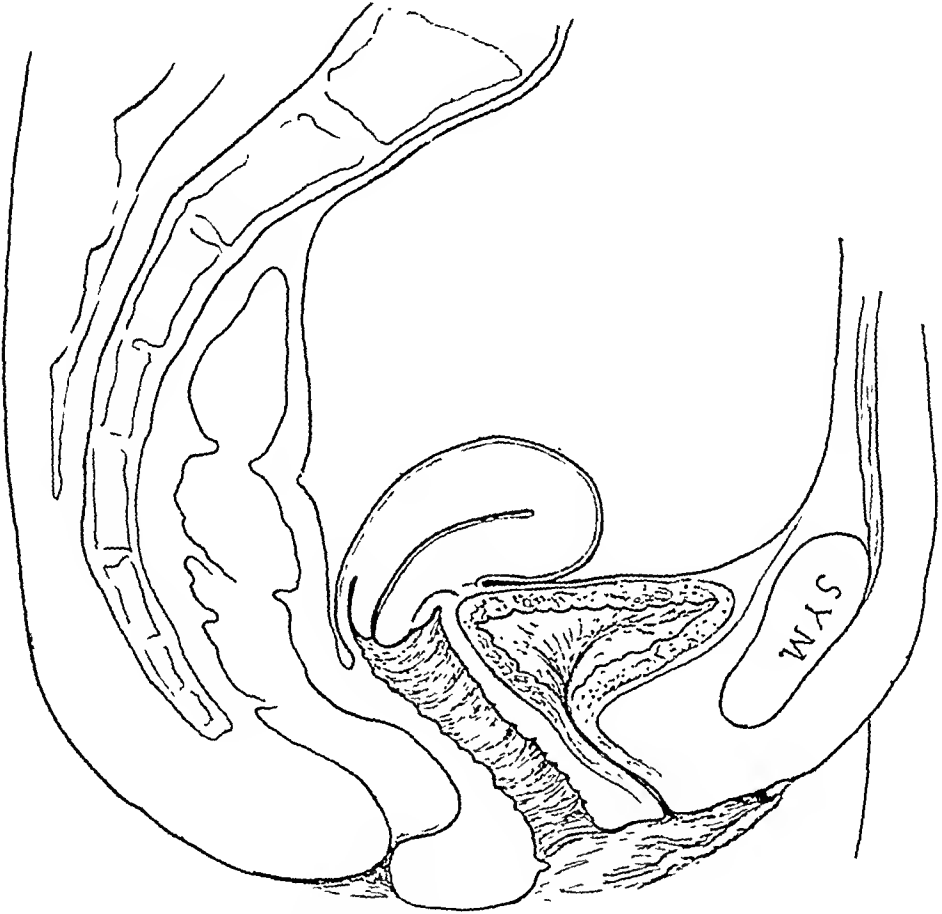


FIG. 234.—NORMAL RELATION BETWEEN ANTERIOR VAGINAL WALL, CERVIX, AND BLADDER.

Note invagination of cervix and the "douche bag" shape of bladder.

cervix is torn away during labor and with it the bladder attachment, destroying the normal depth of the invagination of the cervix in the anterior fornix. This creates a weak spot in the median line in front of the cervix which favors a gradual prolapse or hernia of the bladder—an injury readily demonstrated with a sound in the bladder. Where the bladder and vagina have been torn away from the front of the cervix, the tip of the sound is felt almost at the external os, showing the descent of the bladder and the loss of the normal invagination of the cervix with an obliteration almost of the anterior vaginal fornix, while in the uninjured the tip of the sound is several centimeters above the os.

In prolapse where the cervix lies at the vulva, with the body of the uterus in its normal position, the protrusion of the cervix is caused by its marked elongation due to traction of the anterior vaginal wall on the cervix at its attachment below the base of the broad ligaments, resulting from this common injury.

The prolonged dragging on the base of the bladder and the vaginal wall caused by the prolapse, effects an actual demonstrable increase in the antero-

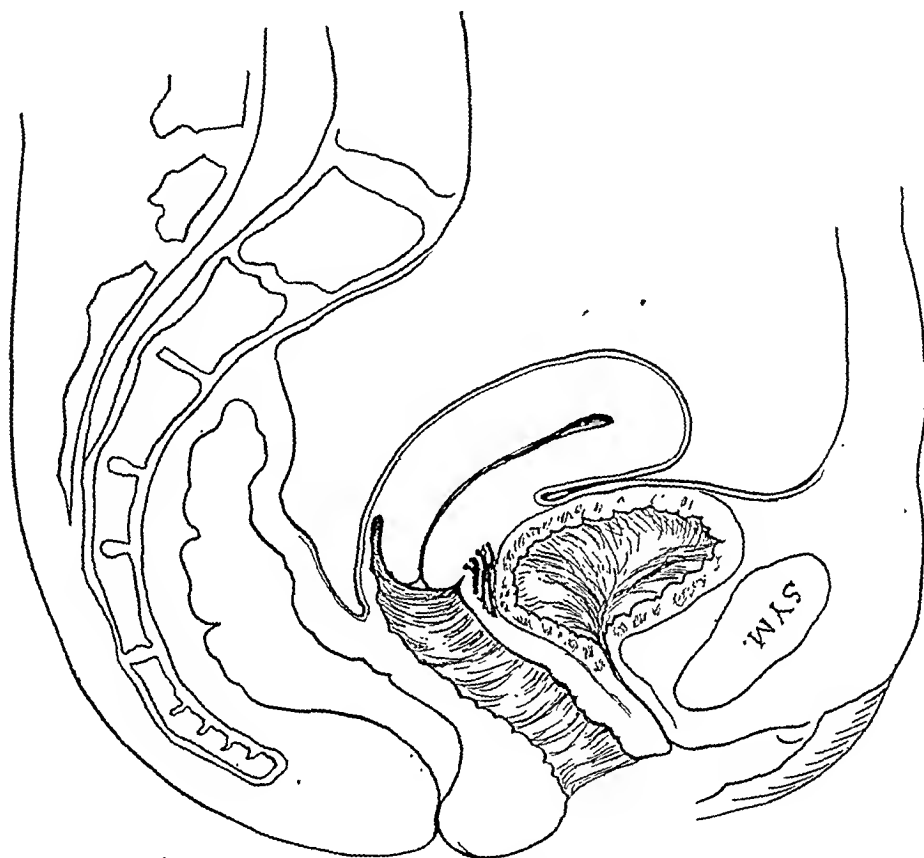


FIG. 235.—TEARING AWAY OF VAGINAL WALL AND FASCIA AT ITS POINT OF ATTACHMENT TO CERVIX, SHOWING DEVELOPMENT OF "WEAK SPOT" AS A RESULT OF INJURY DURING PARTURITION.

posterior measurements of these parts, so that in a cystocele of any moment, the bladder base and anterior vaginal wall are both lengthened. Careful measurements on normal patients and on a plaster cast made from the cadaver of a parous woman with uninjured structures, show that the average normal length of the anterior vaginal wall from its junction with the cervix to the external meatus is 6 to 7 centimeters, while repeated measurements on well-marked cases of cystocele show an average of 10 to 11 centimeters. This anteroposterior increase in the length of the vaginal wall and bladder base is an important factor in the correction of cystocele.

As the formation of a cystocele progresses, the fibers forming the uteropubic fascia, or so-called bladder pillars, extending from the base of the broad

ligaments to the pubes, become attenuated and separated in the midline, and the continued stretching results in a thinning of the vaginal wall in the center and an increase in the transverse dimension of the vagina and bladder base. This lateral increase is of less importance than the anteroposterior, although attention is usually focused upon it; many operations in vogue rely mainly on the correction of this lateral stretching to cure the cystocele.

When cystocele is associated with a marked prolapse of the uterus, it necessitates a uterine retrodisplacement as well—a descent in the line of the curve

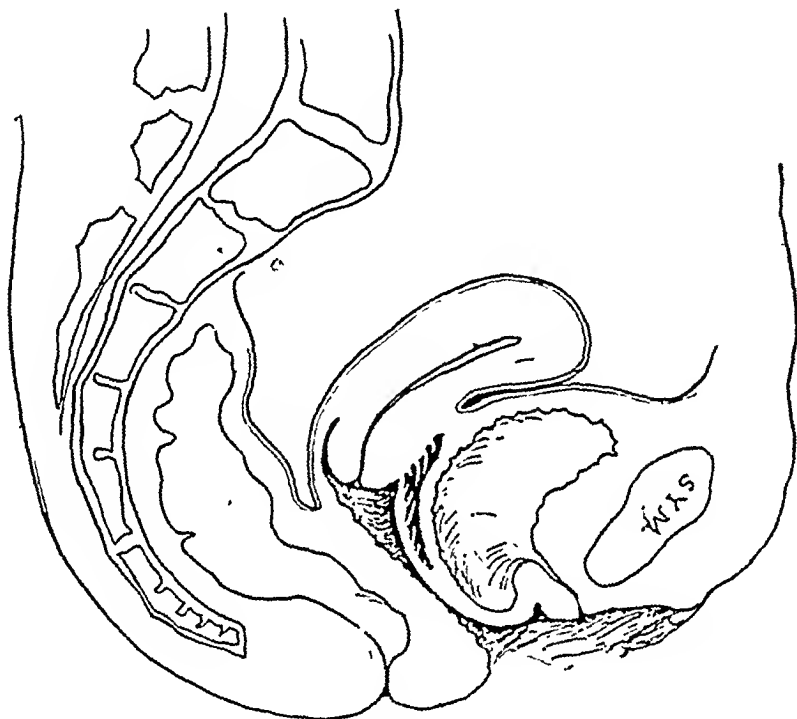


FIG. 236.—WIDENING OF "WEAK SPOT" WITH CONSEQUENT LOSS OF INVAGINATION OF CERVIX AND DESCENT OF BLADDER WITH INCREASED LENGTH OF VAGINAL WALL AND BLADDER BASE DUE TO STRETCHING, THUS RESULTING IN THE FORMATION OF A CYSTOCELE.

Note "teapot" shape of the bladder, making complete evacuation difficult.

of Carus, with a resulting failure of the deflection of intra-abdominal pressure normally effected by the anteverted posture of the uterus. Cystocele and prolapse are practically always associated with an impaired pelvic floor function due to relaxation or injury resulting from childbirth.

We can summarize these injuries to the anatomical structures playing a part in the etiology of cystocele as follows:

1. Detachment of the anterior vagina and the bladder from its normal relation to the anterior cervical wall with loss of the normal invagination of the cervix and a resultant weak spot at this site due to injury to the attachment of the uteropubic fascial structures to the cervix and bases of the broad ligaments.

2. Attenuation and separation of the fibers of the uteropubic fascia, the result of stretching.
3. Displacement downward of the bladder.
4. Anteroposterior increase in the length of vaginal wall and bladder base.
5. Transverse increase in width of the vaginal wall and bladder base.
6. Thinning of the vaginal wall in the midline and complications (7 and 8).
7. Prolapse of the cervix with the uterine body *in situ*, the result of traction by the prolapsed vaginal walls.

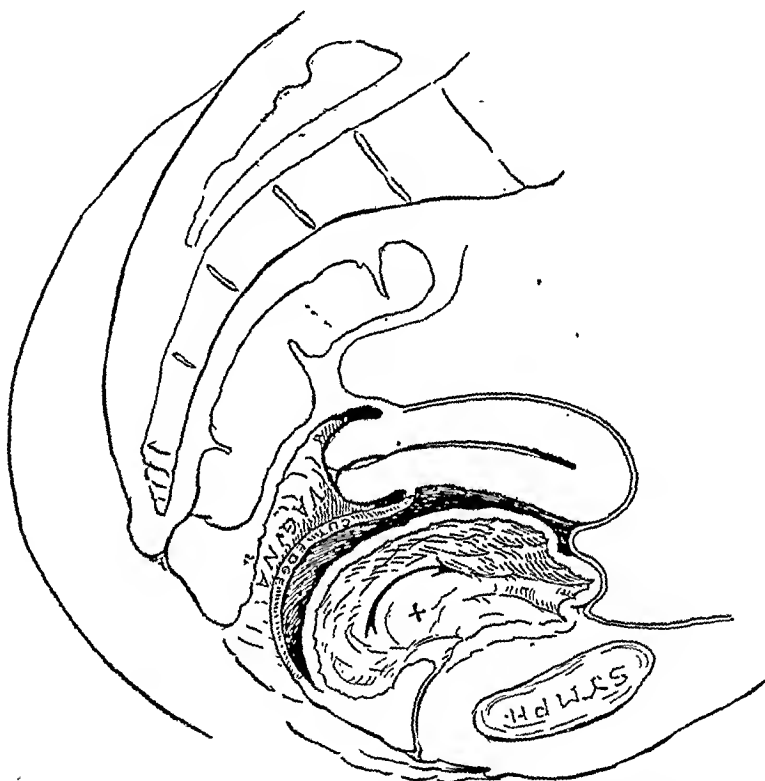


FIG. 237.—PRINCIPLE EMPLOYED TO CORRECT CYSTOCELE IN THE CHILDBEARING WOMAN.

First step: Mobilization of bladder by separating it from vagina and uterus to replace it higher up by rotation about its transverse axis.

8. Prolapse of the uterus with associated retrodisplacement, the result of injury and stretching of the uterine supports with the consequent lack of function of the involuntary muscle-fibers on account of atrophy.

Repair.—Two mechanical principles are involved in the correction of these injuries; namely, suspension and support. Interposition of the uterus or broad ligaments is, of course, a form of support below the bladder applicable only in the nonchildbearing.

Intelligently to discuss cystocele we must first determine whether childbearing is or is not a factor to be considered, and whether the cystocele is accompanied by prolapse of the uterus. The problem for consideration in the young childbearing woman is utterly different from that in a woman whose

uterus is incapable of reproduction or is past that period. The methods at our disposal for the repair of cystocele where childbearing is not a factor are more certain of a permanent cure in their final results than are the methods available where the parts must be called upon to bear the strain of subsequent labors.

A. *Childbearing Women*.—In childbearing women it is essential to employ principles in the repair which will simultaneously restore the parts as nearly

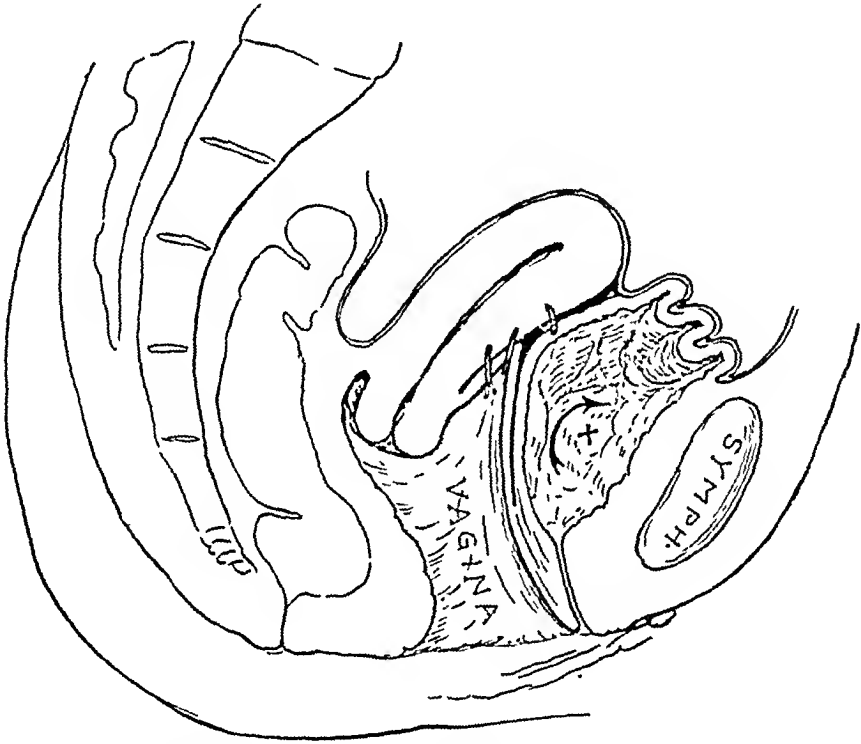


FIG. 238.—PRINCIPLE EMPLOYED TO CORRECT CYSTOCELE IN THE CHILDBEARING WOMAN.

Second step: Bladder replaced and straightened by upward traction of vaginal wall, thus disposing of its excess length. Bladder base attached to anterior surface of uterus by suture. Vaginal wall attached by two sutures to uterus at a point above internal os, thus angulating vagina and disposing of its excess length, anteverting uterus, restoring invagination of cervix, and repairing injury which caused the "weak spot."

as possible to their normal relations, that the function of reproduction may not be disturbed.

To fulfill our requirements for an operation suitable for the childbearing woman, we must, therefore, whatever procedure is employed, secure the correction of all the injuries by meeting the following requirements:

1. Mobilization and elevation of the prolapsed bladder in the pelvis, disposing of the enlarged bladder base, Figure 237.

2. Reattachment of the vaginal wall and the bladder pillars (uteropubic fascia) to the anterior cervical wall, high up above the pivot point, thus angulating the vagina and using it as a tractor on the bladder base, at the same time disposing of its excess length and restoring the invagination of the cervix and anteverting the uterus, Figure 238.

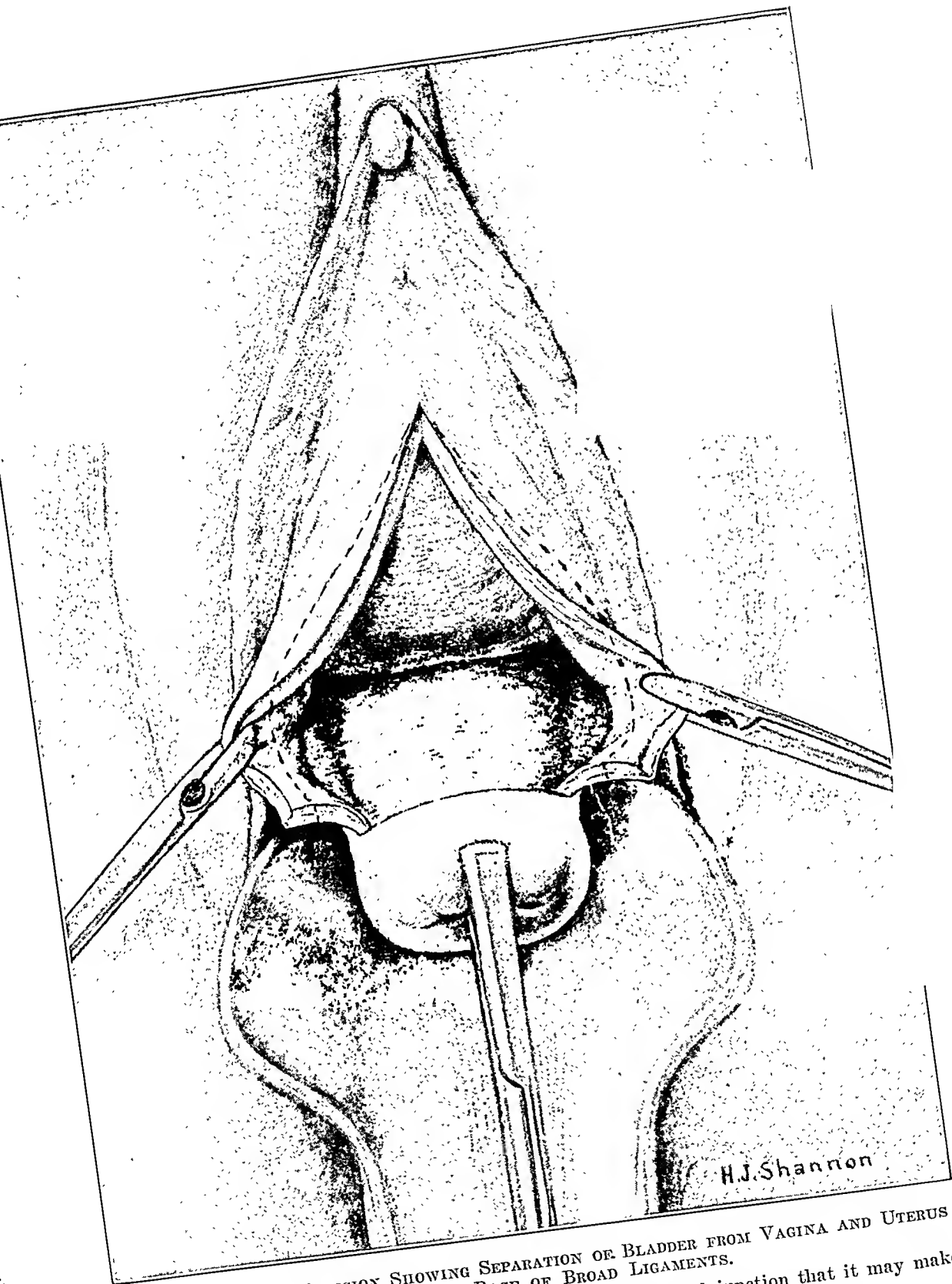


FIG. 239.—1-SHAPED INCISION SHOWING SEPARATION OF BLADDER FROM VAGINA AND UTERUS AND EXPOSING BASE OF BROAD LIGAMENTS.

Bladder is not widely separated from vagina at urethrovesical junction that it may make traction on bladder base. Dotted lines indicate excess vaginal wall to be cut away.

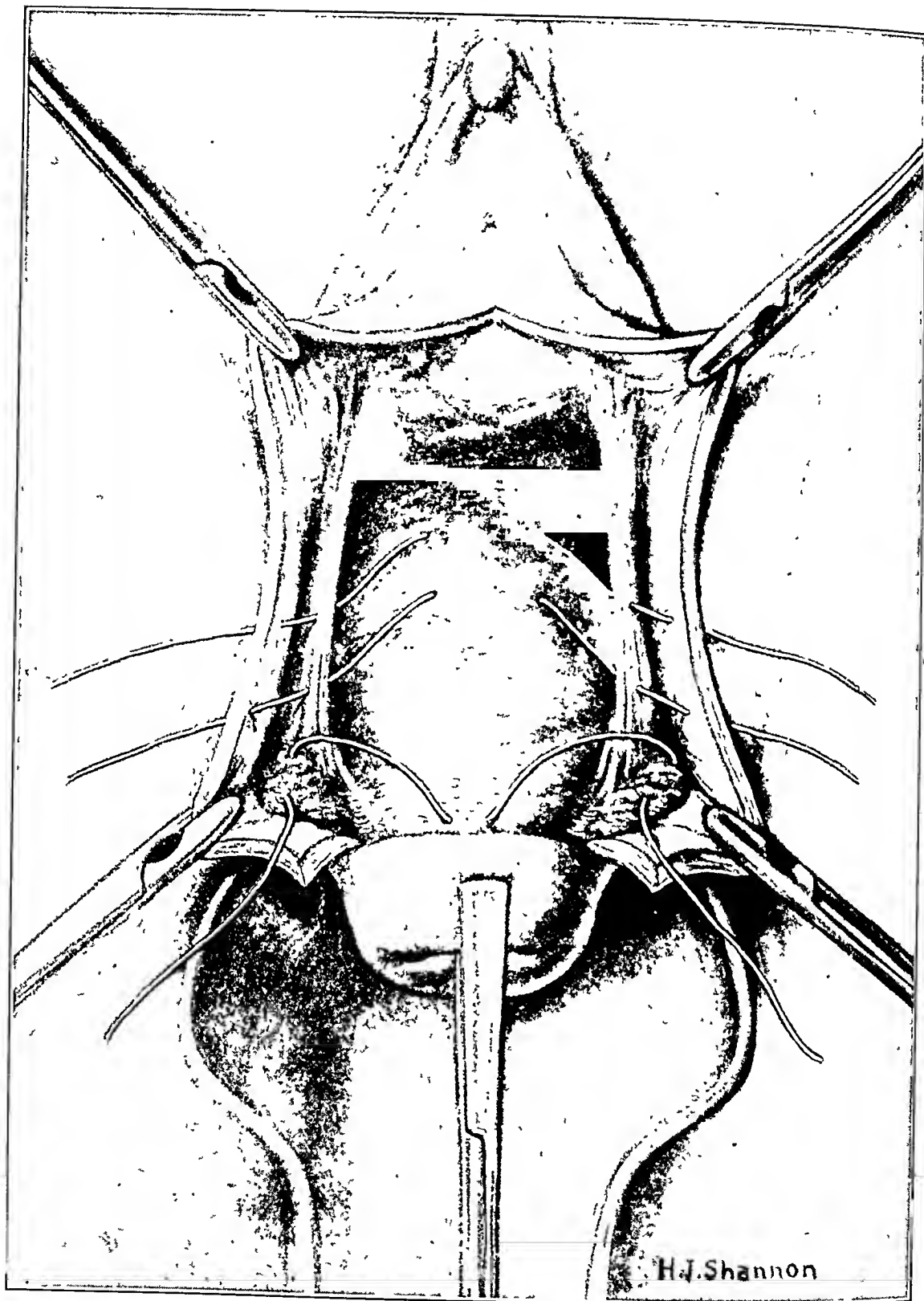


FIG. 240. DISSECTION OF UTEROPUBIC FASCIAL PLANE ("BLADDER PILLARS"), SHOWING ITS ORIGIN FROM BASE OF BROAD LIGAMENTS.

Two angulation sutures *in situ*, passing through vaginal walls, "bladder pillars," and uterine wall above internal os. Mattress-suture picks up base of broad ligaments on each side and cervix in midline at a lower level after technique of Alexandroff. When this suture is tied, broad ligaments are approximated and reefed, cervix is thrown backward, and uterus elevated.

3. Approximation of the attenuated fibers of the uteropubic fascia at the bladder base to give support in the center.

4. Resection of the excess thinned and stretched vaginal wall in the median line.

5. In cases complicated with prolapsus uteri, reefing of the elongated base of the broad ligaments, by approximation in front of the cervix, thus elevating the uterus and throwing back the cervix so that the uterus will become anteverted, in order that it may deflect intra-abdominal pressure.

In all cases complicated with prolapsus uteri with an associated retroversion, shortening of the uterosacral and round ligaments is a necessary addition.

Endeavoring to fulfill these essential conditions, we have employed the following technique:

A \perp -shaped incision is made on the anterior vaginal wall extending its entire length, the head of the \perp being carried out wide enough to bare the bases of the broad ligaments. The line of cleavage is found between the bladder and vaginal wall, Figure 239. The uteropubic fascial tissue is found firmly attached to the vaginal wall and the surface of the bladder, with its terminal attachments to the sides of the cervix and bases of the broad ligaments below and the posterior surface of the symphysis above. Traction upward on the bladder will develop the location of the attachment of this fascia to the broad ligament base on each side of the cervix. It is often found separated or attenuated in the midline near the cervical end, thus causing a weak spot through which the hernia of the bladder (cystocele) has developed.

The uteropubic fascial structure is next dissected from each half of the anterior vaginal wall. This is readily done if the vaginal wall is first put on the stretch by making traction with forceps attached to the margins, and a superficial incision is made with a scalpel throughout the length of the wall about 0.5 centimeter from its edge just sufficient to cut through the fascia. A piece of gauze on the end of the index finger is used for a blunt dissection of the fascial plane from its vaginal attachment which is easily separated. Take care not to detach this fascia from the bladder surface but from the vagina, as shown in Figure 247.

The bladder is now carefully separated from the cervix, using blunt scissors to start the dissection and keeping close to the cervix to avoid injuring the bladder; after the line of cleavage is found, the gauze-covered finger pushes the bladder upward until it is completely detached from the uterus, Figures 248 and 249.

In cases complicated with prolapse, the bases of the broad ligaments are freely exposed.

Unless some intra-abdominal condition necessitates invasion of the peritoneum, the peritoneal reflection of the bladder is not opened. The bladder is picked up with a forceps in the midline at such a point that when it is carried

up to the anterior surface of the uterus above the internal os in the center, the base of the bladder is straightened out and the organ is revolved on its transverse axis, the excess due to stretching being carried up into the pelvis to become firmly adherent to the uterus in its new position.

These points on the bladder base and uterus being ascertained, they are sutured together with a catgut stitch after the technique of Goffe. It is unnecessary in the average case to use three sutures to spread the bladder out on the broad ligaments as Goffe does, except in very large cystoecles. The edges of the vaginal incision are then resected to remove the overstretched and thinned-out tissue in the midline. Two sutures of catgut are passed through the edge of the vaginal wall including the edge of the uteropubic fascia (the bladder pillar) of the same side and through the uterine wall in the midline above the pivot point at the internal os close under where the bladder has been already attached, and out through the fascia and vaginal edge of the other side. These sutures are so placed in the vaginal wall that when tied they completely straighten out the slack of the wall, making traction on the bladder base and bringing them in contact, and by the angulation produced disposing of its excess length, Figure 240.

If there is an accompanying prolapsus uteri, the head of the L-shaped incision is extended laterally on the sides of the cervix to permit the isolation of the lower part of the broad ligaments. Under guidance of the finger hooked under the ligament, a catgut suture is passed in the form of a mattress stitch, which takes a firm hold on the strong lower portion of the ligament below the site of the vessels and ureter, well out on each side, and includes the cervix low down in the midline, after the method of Alexandroff, Figure 240. When this suture is tied it approximates the bases of the broad ligaments in front of the cervix, reefing them, and elevating the uterus and throwing back the cervix. After these three sutures are placed and before they are tied, a continuous half hitch suture of catgut brings together the fascial edges of the bladder pillars under the bladder base, Figure 241. The mattress stitch of Alexandroff (*Zentralbl. f. Gynäk.*, 1903, 27) and the two angulation sutures are then tied, and the remainder of the vaginal incision closed with interrupted sutures, Figure 242.

If there is no appreciable prolapse and the uterus lies well forward, it is not necessary to reef the base of the broad ligaments as just described.

Where there is a tendency to persistent oozing of blood, a rubber tissue drain inserted on each side of the line of suturing is a wise precaution, and will prevent the formation and possible infection of an hematoma, Figure 255.

When the cervix is elongated a low amputation should be done.

The restoration of the function of the pelvic floor is of course essential (Chapter XVIII), and if marked retrodisplacement is associated with the prolapse, shortening of the uterosacral and round ligaments is also a necessity.

It will be seen from the above described technique that an attempt is

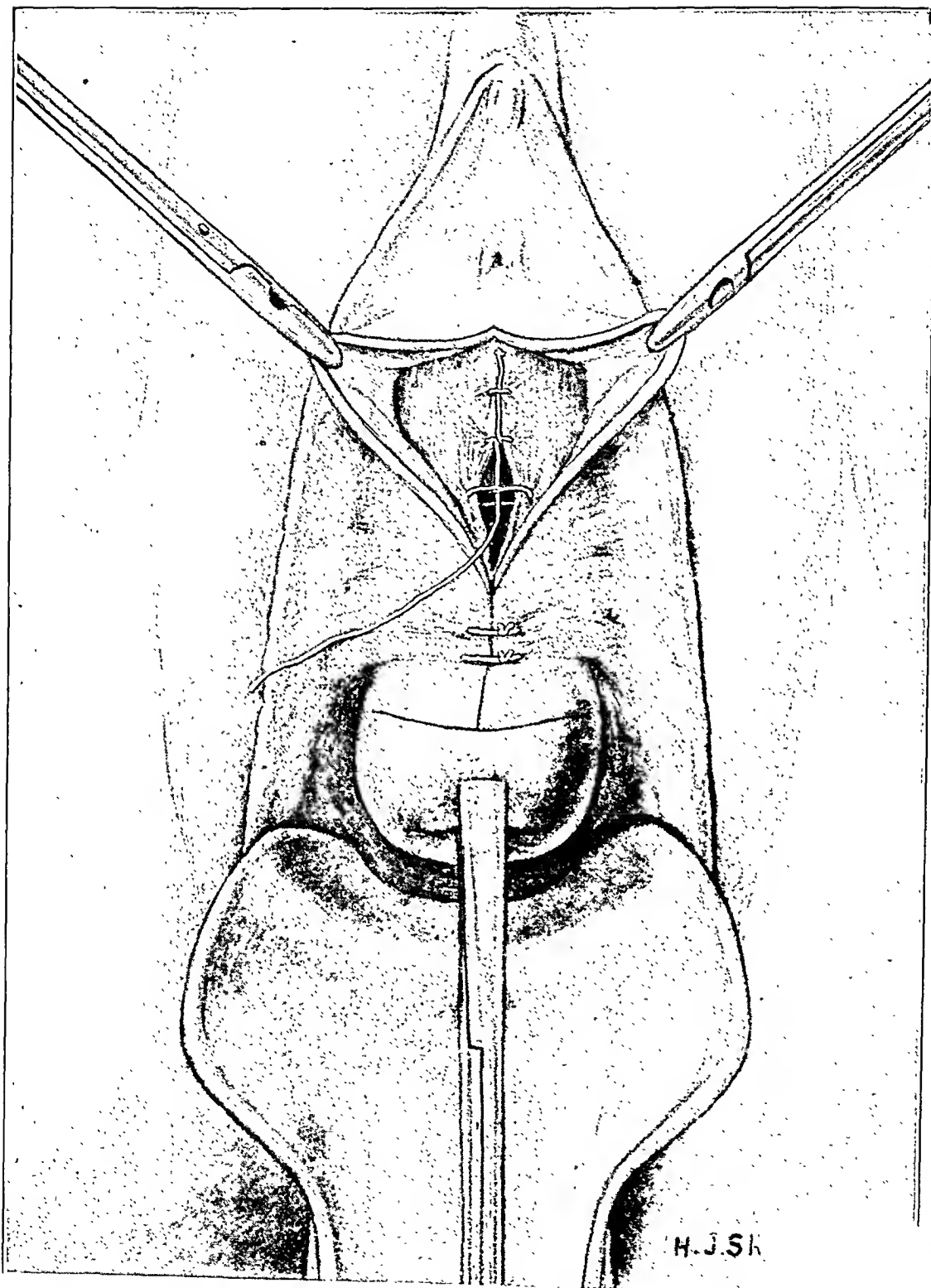


FIG. 241.—Two ANGULATION SUTURES TIED.

Alexandroff stitch not shown as it is buried. Uteropubic ligaments are sutured with a lock stitch.

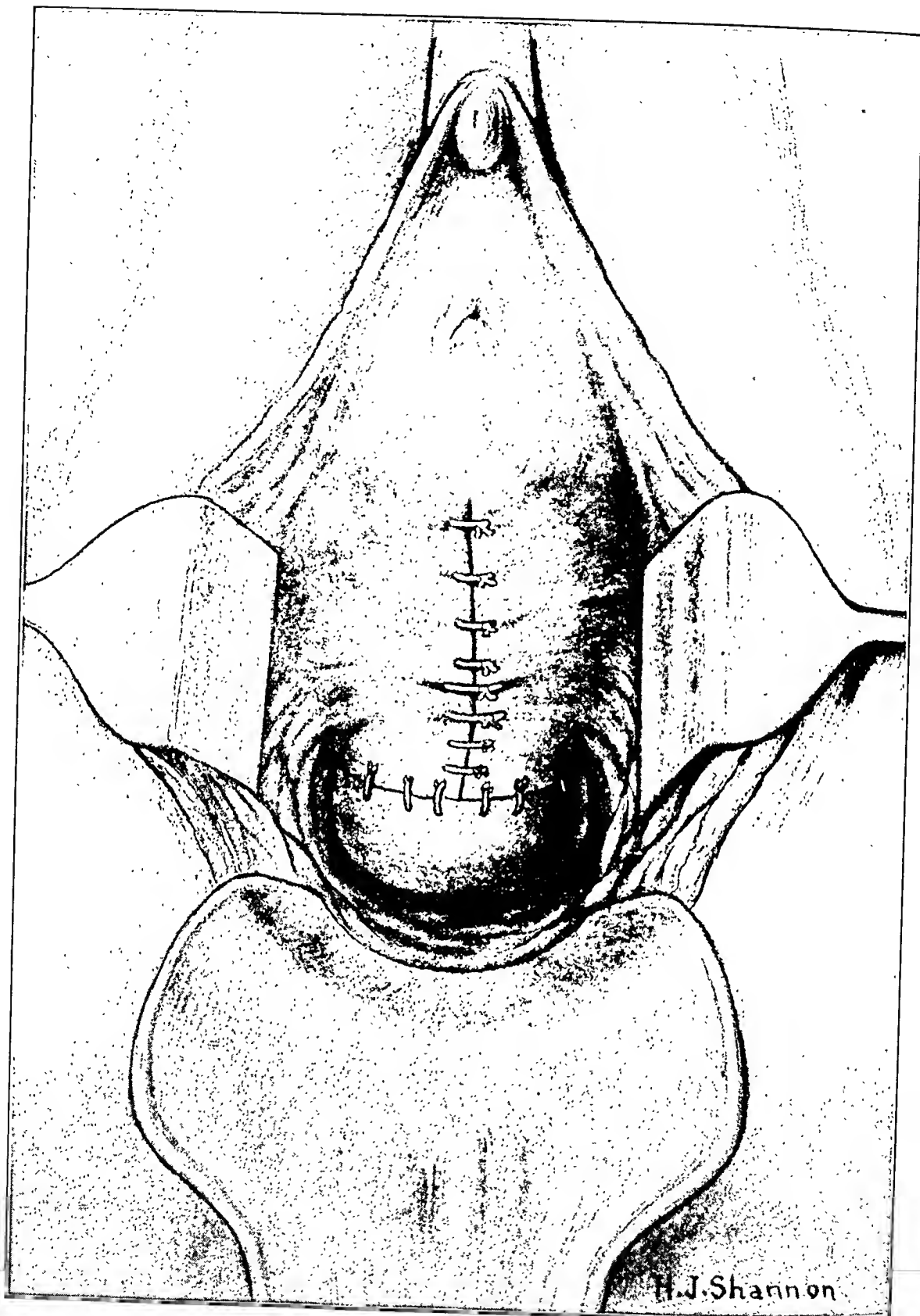


FIG. 242.—1 INCISION CLOSED BY INTERRUPTED SUTURES.

Anterior vaginal wall now straightened, cystocele and prolapse have disappeared. Invagination of cervix restored; cervix points toward hollow of sacrum.

made to correct all the injuries and deviations from the norm by combining the principles of several operations. This technique might appropriately be designated as a combination of Hadra, Goffe, Martin, Frank, Alexandroff,

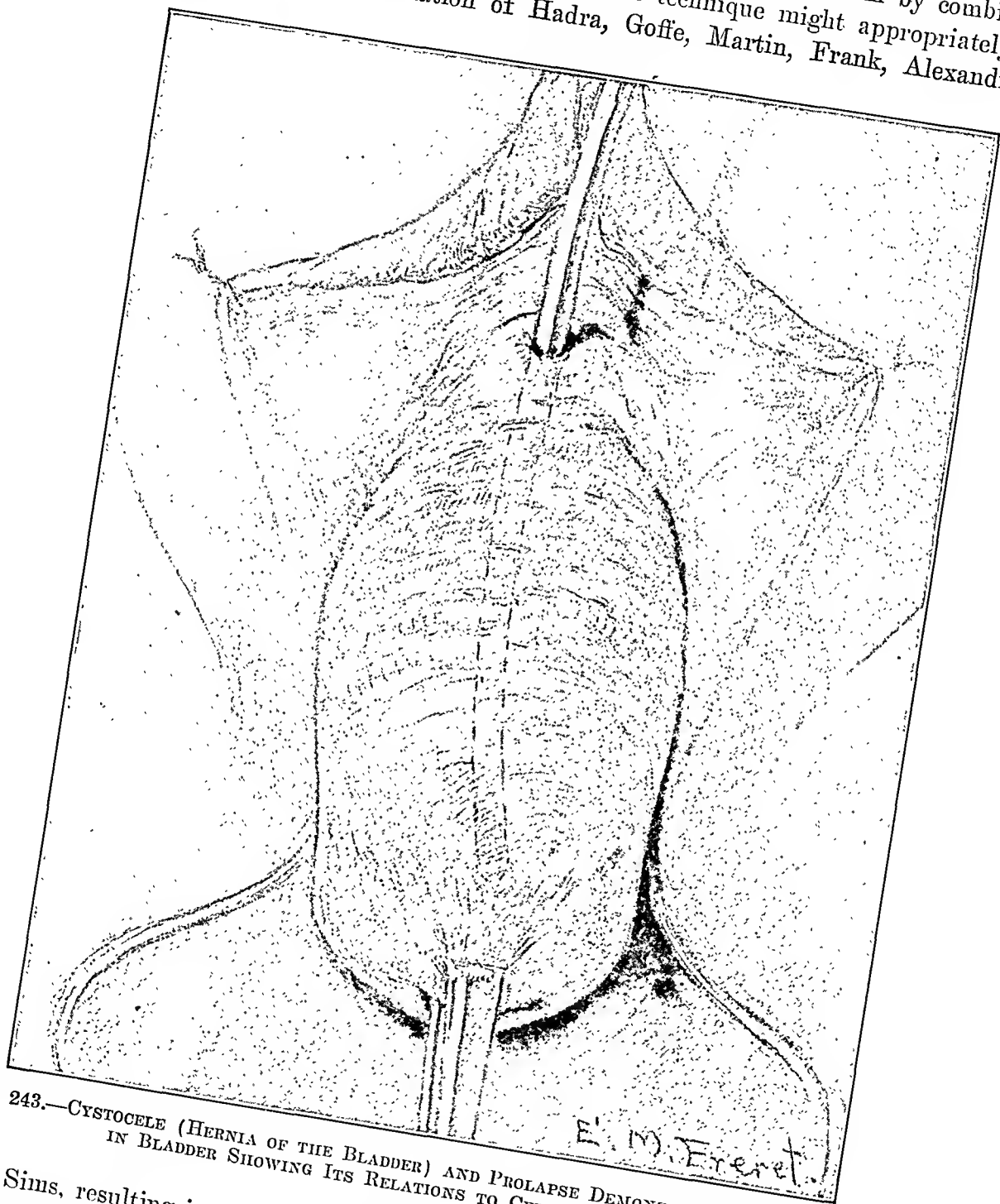


FIG. 243.—CYSTOCELE (HERNIA OF THE BLADDER) AND PROLAPSE DEMONSTRATED WITH SOUND IN BLADDER SHOWING ITS RELATIONS TO CERVIX AND VAGINA.

and Sims, resulting in reduction of the hernia, replacement of its supports by overcorrection—the principle usually employed in hernia operations, overcoming the excess of bladder base and vaginal wall, anteroposteriorly as well as transversely, with a restoration of the anterior invagination of the cervix, and

the elevation and anteversion of the uterus. A composite operation is necessary in view of the various factors concerned in this complicated injury. Reliance upon one principle alone invites failure as surely as "a chain is no stronger than its weakest link."

We call this operation a cystopexy rather than use the unsuitable term "anterior colporrhaphy," as "cystopexy" describes the general character of the

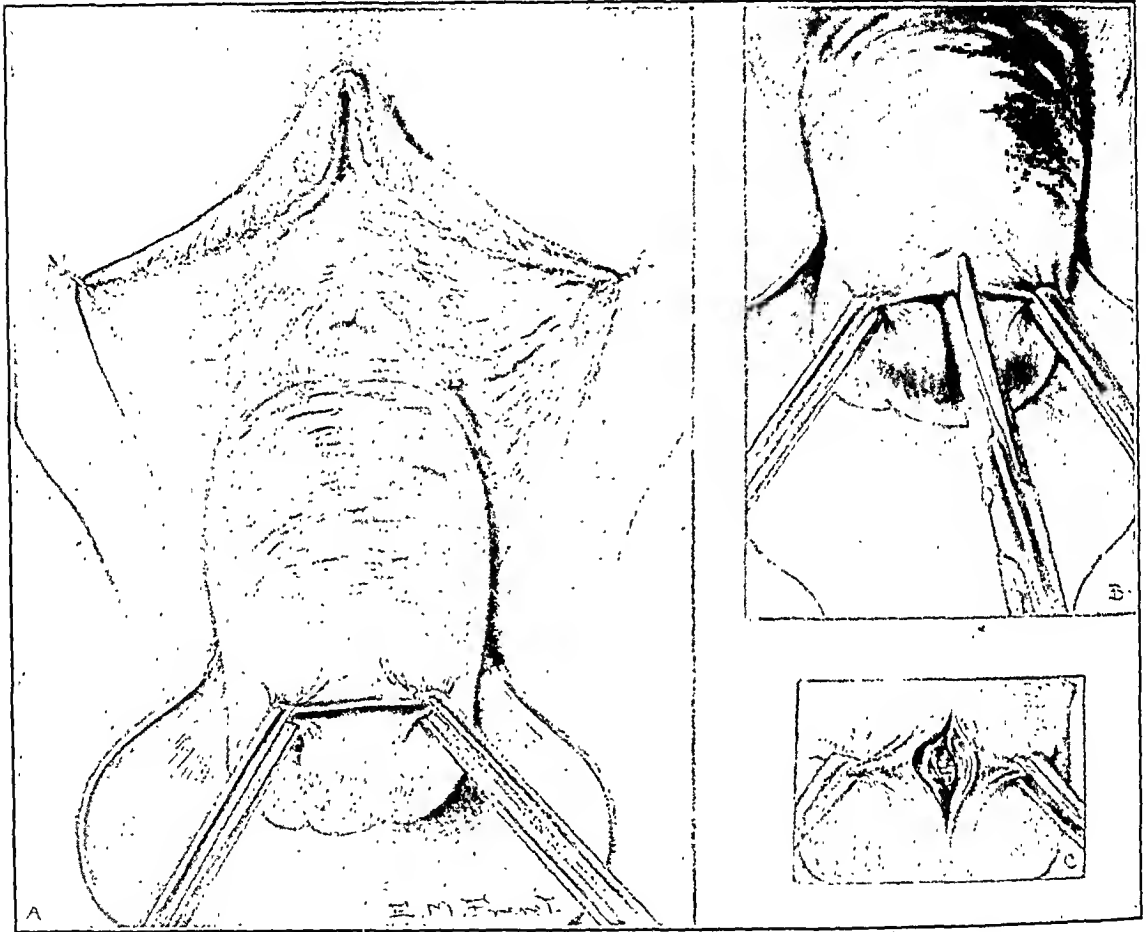


FIG. 244.—VAGINAL WALL CAUGHT WITH TWO CLAMPS PLACED EACH SIDE OF MIDLINE, THROWING MUCOSA INTO A TRANSVERSE FOLD.

This is cut with scissors as shown, giving access to line of cleavage.

operation and is as applicable as "nephropexy" in the fastening up of the kidney.

The salient points are epitomized as follows:

1. The composite nature of the injury.
2. The aim to correct all lesions, avoiding any weak link.
3. The mobilization and elevation of the bladder with a positive fixation.
4. A matter of prime importance, it disposes of the excess bladder base and the increased anteroposterior length of the vaginal wall, the result of stretching.

5. It restores the normal attachment of the vagina to the cervix and insures its invagination and the eradication of the weak spot.

6. The attachment of the uteropubic fascial ligaments and the vaginal wall above the pivot point is utilized, so as to overcorrect the hernia and insure anteversion of the uterus.

7. The technique provides for correction of any associated uterine prolapse and retrodisplacement.

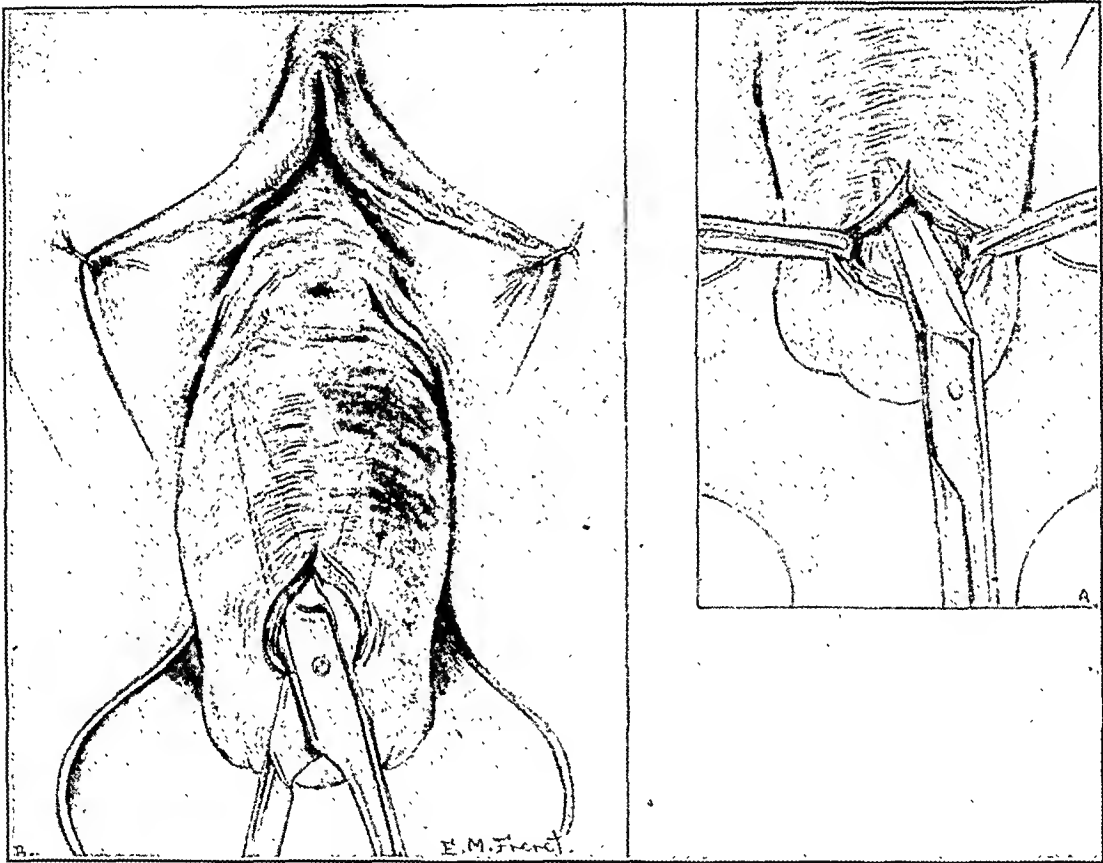


FIG. 245.—BLUNT-POINTED SCISSORS PASSED CLOSED INTO LINE OF CLEAVAGE BETWEEN VAGINAL WALL AND BLADDER, THEN OPENED AND WITHDRAWN WITHOUT CLOSING, THUS SEPARATING THESE STRUCTURES.

B. Nonchildbearing Women.—In nonchildbearing women we may employ any principles in the repair calculated to produce the most positive fixation of the organs irrespective of their normal relations. The nonchildbearing cases which are not accompanied with prolapse beyond the second degree, are readily and satisfactorily corrected by the Watkins method of interposition, provided the uterus is normal. Unfortunately, in a large number it is not safe nor wise to retain the uterus. If the uterus is diseased, or unsuitable for the purpose on account of its size, this operation is not advisable. Here Simpson's suggestion (*Tr. Am. Gynec. Soc.*, 1915, 40) of partial removal of the uterus, resecting the mid-portion of the body and uniting the lateral walls by suture

in order to remove the diseased area or to reduce its size, followed by the interposition of the reconstructed organ under the bladder, may satisfactorily solve

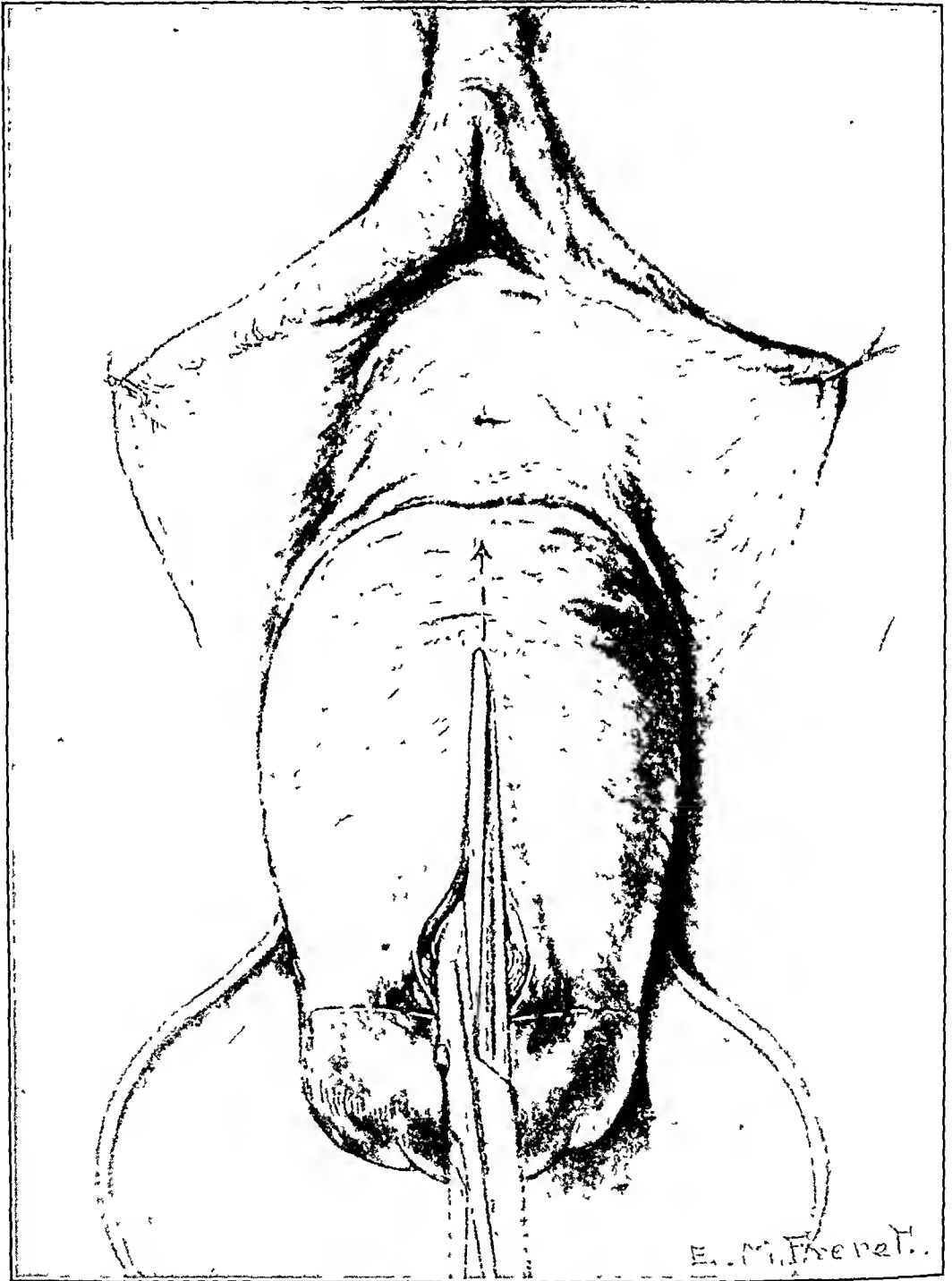


FIG. 246.—VAGINAL WALL DIVIDED WITH SCISSORS AS SHOWN, MAKING A T-SHAPED INCISION.

the problem. In the nonchildbearing, with marked or complete prolapse, we find most satisfactory a modification of the Mayo operation, in which a vaginal hysterectomy is done, and the broad and round ligaments are sutured together and interposed beneath the bladder, the tops of the ligaments being firmly

anchored to the sides of the pubic arch close under the urethra, and, finally, the vaginal wall sutured to the united ligaments. This operation, properly done, permanently cures the condition. It is very important that the culdesac of Douglas should be obliterated in complete procidentia, lest an enterocele

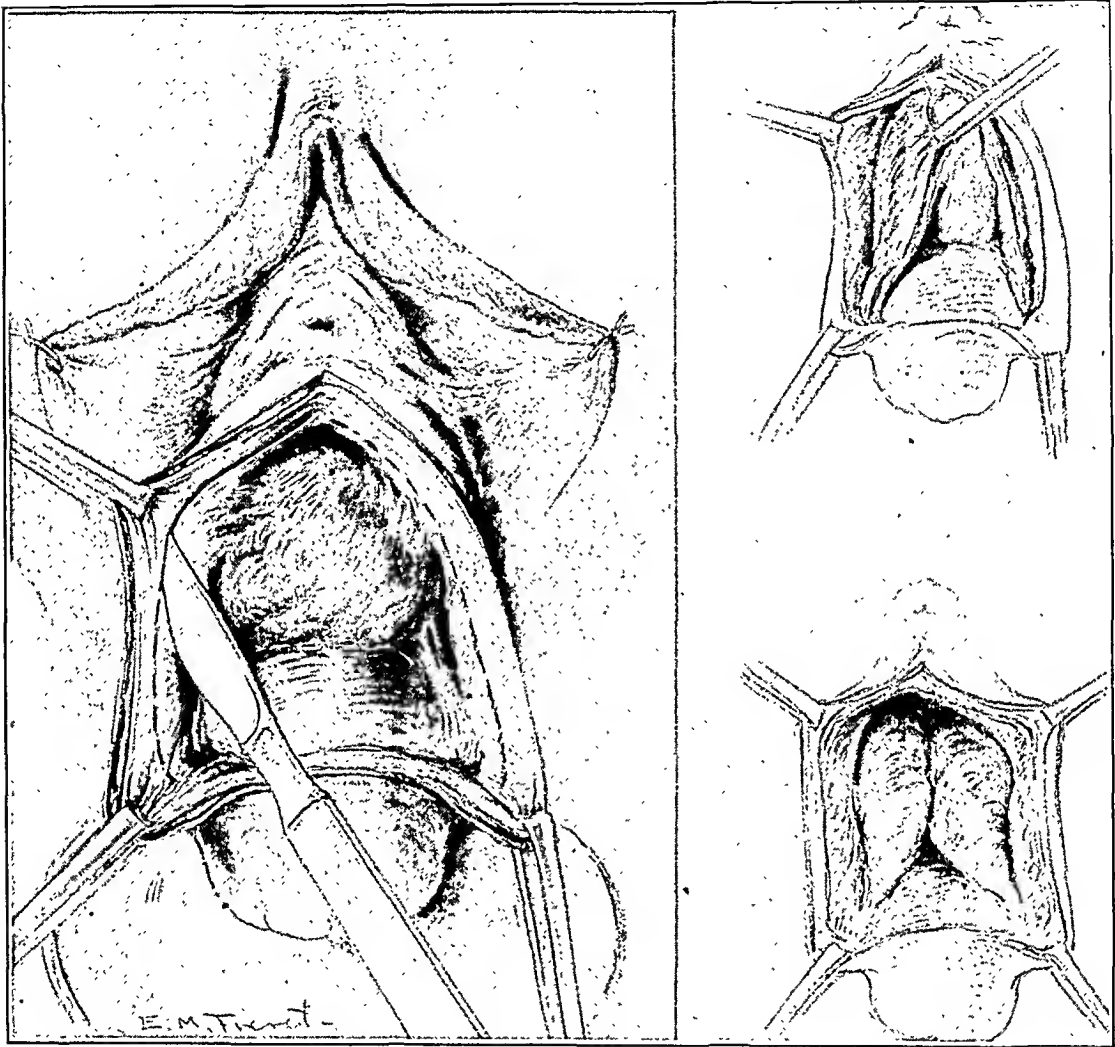


FIG. 247.—VAGINAL WALL OPENED WITH L-SHAPED INCISION, EXPOSING BLADDER.

Method of dissecting uteropubic fascial plane from vaginal wall, leaving it attached to bladder. An incision with a scalpel separates fascia from vagina and gauze-covered finger strips it back from vagina by blunt dissection.

develop to spoil an otherwise perfect result; the peritoneal pouch of Douglas is, therefore, removed and the uterosacral ligaments united.

Enterocoele is considered in the next chapter, and the technique as shown is applied during the Mayo procedure.

To insure success from either the Watkins (*Am. Gynec. & Obst. J.*, 1899, 15; *Surg., Gynec., & Obst.*, 1906, 2) or the Mayo (*Surg., Gynec., & Obst.*, 1915, 20) interposition operation, we believe it is essential to secure a firm attachment

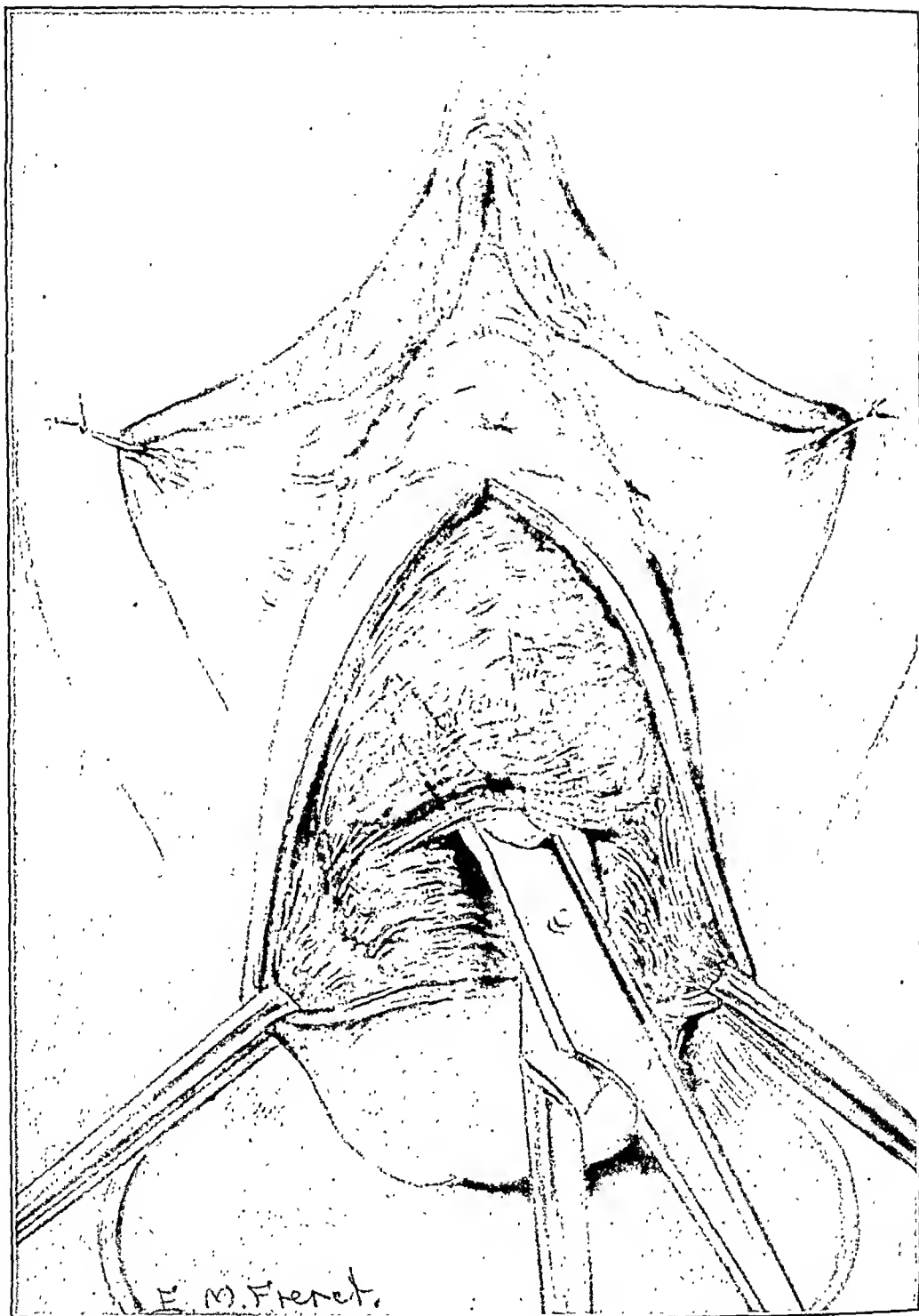


FIG. 248.—BLUNT-POINTED SCISSORS USED TO FIND LINE OF CLEAVAGE BETWEEN BLADDER AND ANTERIOR UTERINE WALL AND TO START DISSECTION, BEING CAREFUL TO KEEP CLOSE TO CERVIX TO AVOID INJURY TO BLADDER.

of the interposed structures to the subpubic arch and we have modified them accordingly.

Modified Watkins Operation.—The anterior lip of the cervix is grasped with a Jacobs forceps and traction downward is made to determine

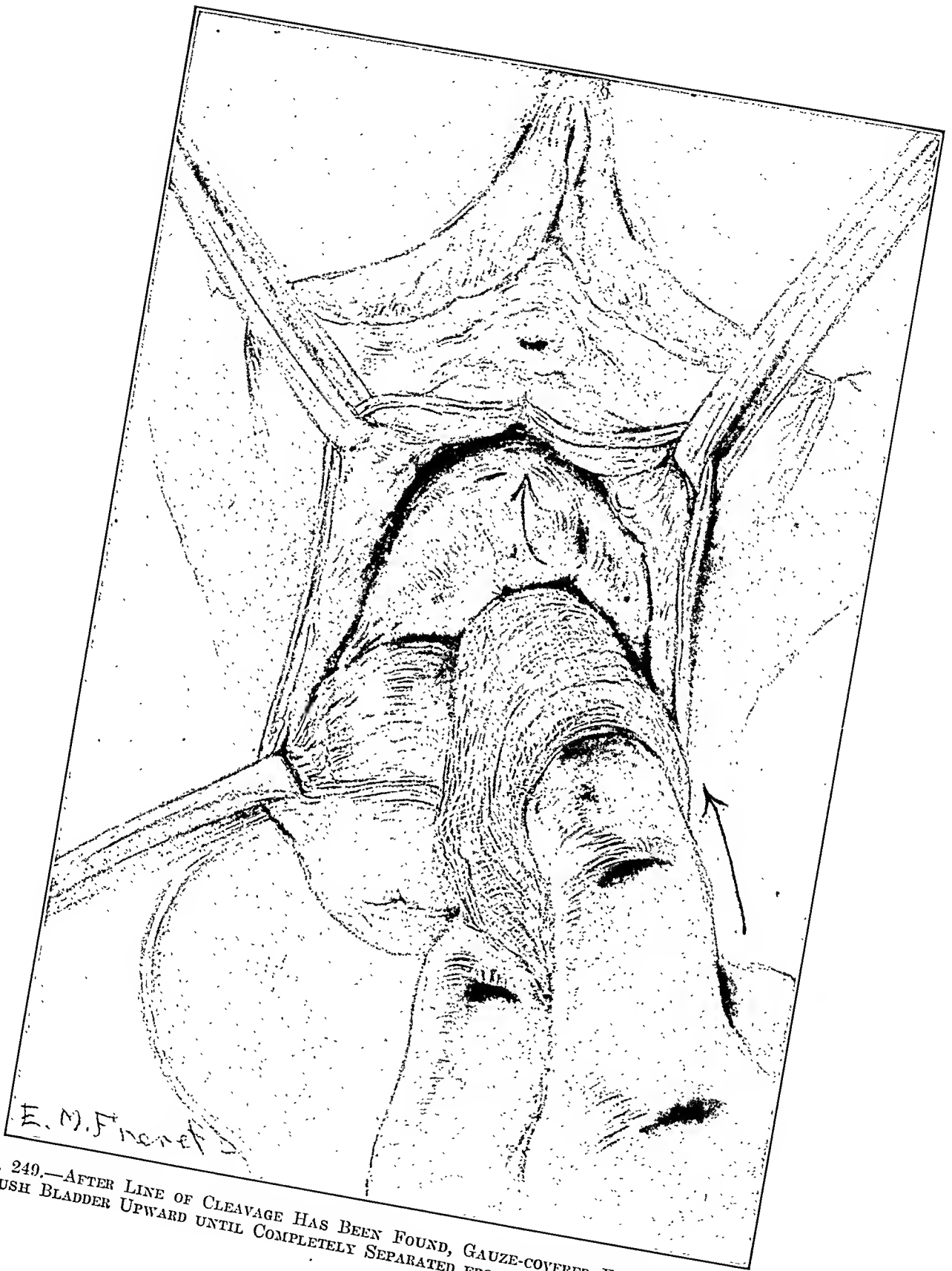


FIG. 249.—AFTER LINE OF CLEAVAGE HAS BEEN FOUND, GAUZE-COVERED FINGER IS USED TO PUSH BLADDER UPWARD UNTIL COMPLETELY SEPARATED FROM ITS UTERINE ATTACHMENT.

the full extent of the prolapse which should not be much more than the second degree for the best result with this technique (when there is an elongation of the cervix, the position of the fundus must be borne in mind in determining the degree of prolapse); a sound is passed into the bladder to demonstrate the exact relation of the cystoccele to the external os of the cervix, Figure 243.

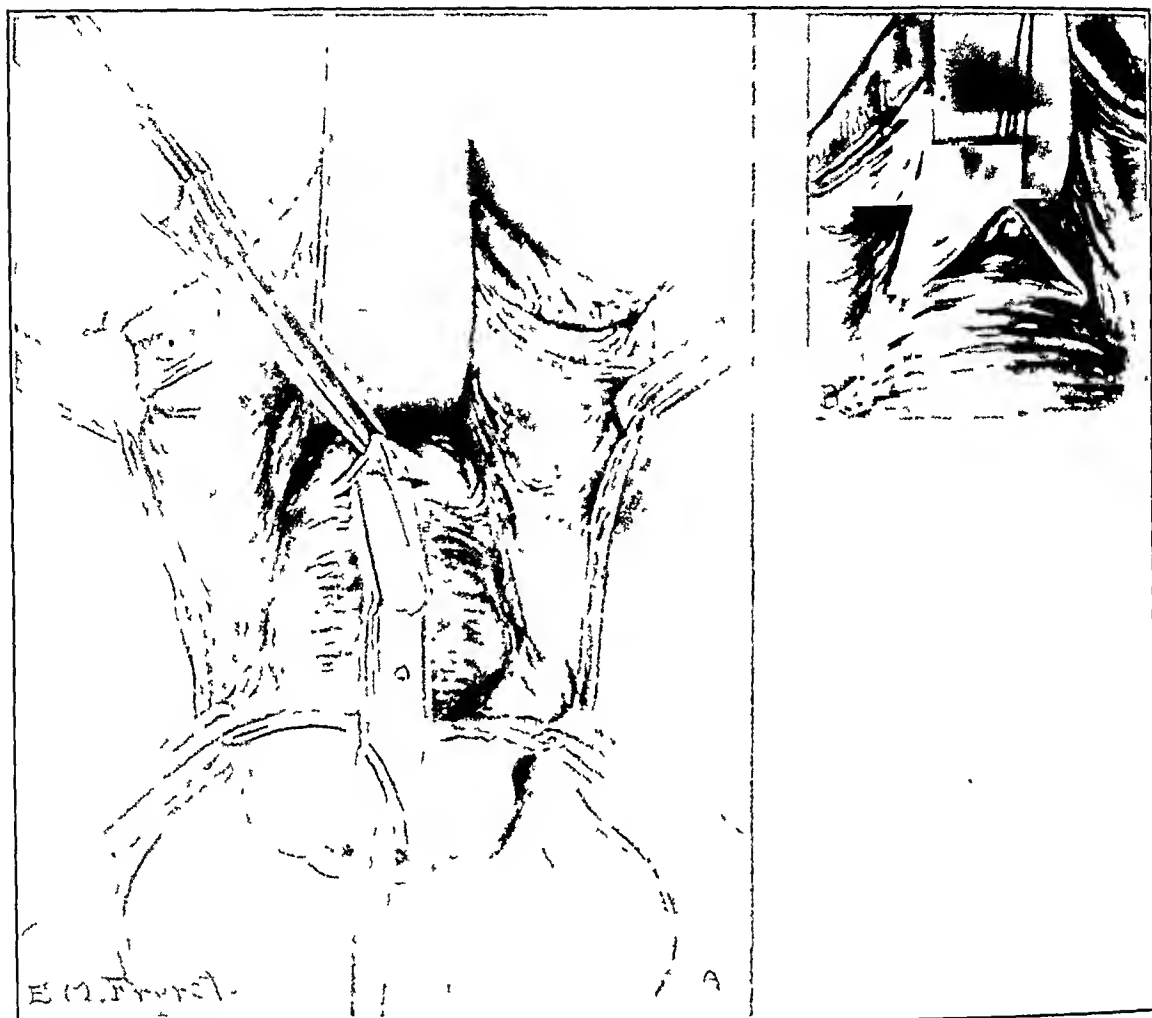


FIG. 250—A. RETRACTOR LIFTS BLADDER ANTERIORLY; PERITONEAL REFLECTION BETWEEN BLADDER AND UTERUS IS PICKED UP WITH FORCEPS AND CUT WITH SCISSORS, THUS OPENING PERITONEAL CAVITY. B. LONG CATGUT SUTURE PASSED THROUGH CUT EDGE OF BLADDER PERITONEUM AND ENDS CLAMPED AND PUT ASIDE.

The anterior vaginal wall is then grasped with two Ochsner clamps at its junction with the cervix, making a transverse fold, which is then cut in the midline with scissors, Figure 244. Closed blunt scissors are pushed up into the line of cleavage between the anterior vaginal wall and the bladder, and opened wide and withdrawn without closing, thus separating the two structures, Figure 245. The vaginal wall is then divided in the midline with the scissors up to the urethra and a transverse cut made at the base forming a 1-shaped incision, Figure 246.

The uteropubic fascial plane is then dissected from each half of the anterior vaginal wall and the bladder separated from its attachments to the uterus as previously described under cystopexy and illustrated in Figures 247 to 249.

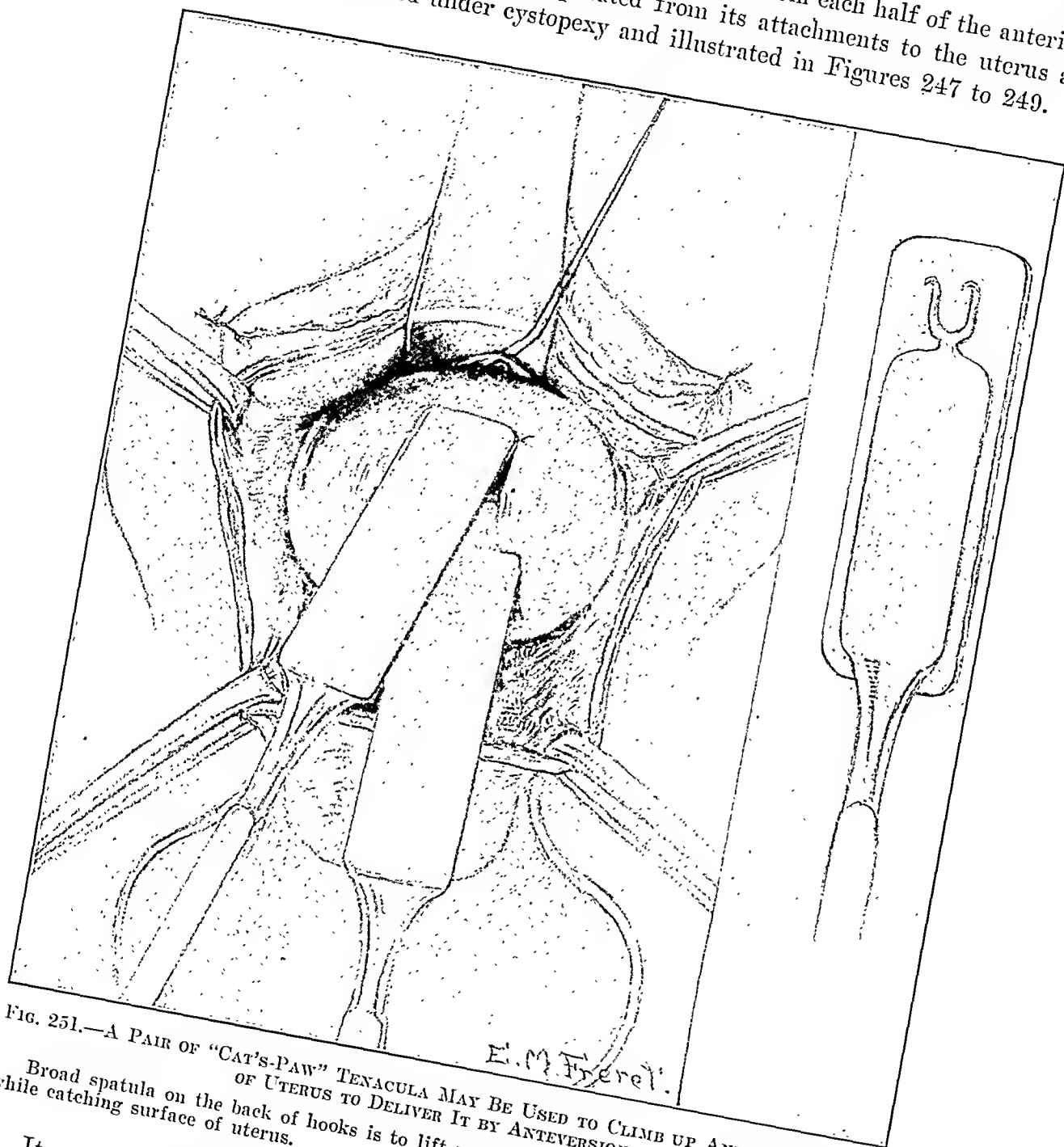


FIG. 251.—A PAIR OF "CAT'S-PAW" TENACULA MAY BE USED TO CLIMB UP ANTERIOR SURFACE OF UTERUS TO DELIVER IT BY ANTEVERSION.
Broad spatula on the back of uterus is to lift up bladder and protect it from sharp hooks while catching surface of uterus.

It seems desirable to leave the fascial attachment to the base of the bladder undisturbed and, therefore, separate the fascia from the vagina rather than from the bladder. Thus there is much less hemorrhage and injury to the base of the bladder with subsequent postoperative irritability of that organ.

A retractor is then placed to lift up the bladder anteriorly and the peritoneal reflection between the bladder and the uterus is picked up with a forceps

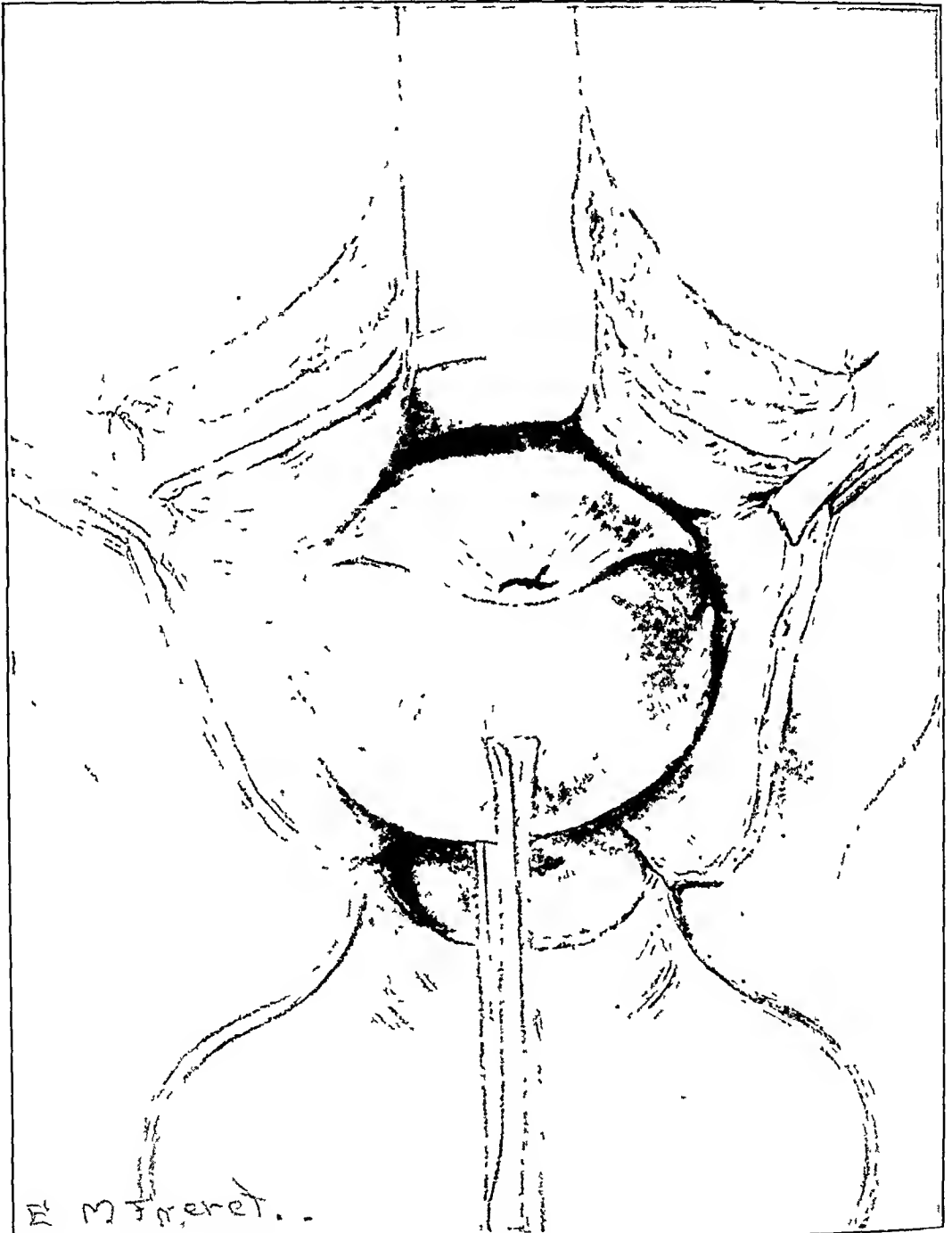


FIG. 252 —FUNDUS OF UTERUS DELIVERED; BLADDER UP IN PELVIS RESTS ON POSTERIOR SURFACE OF UTERUS.

Peritoneal reflection attached to bladder sutured to fundus, thus closing abdominal cavity.

and cut with scissors opening the peritoneal cavity, Figure 250-A. A long cat-gut suture is passed through the cut edge of the bladder peritoneum and the ends clamped and laid aside, Figure 250-B. This allows the bladder to be

brought down easily at a later stage of the operation. The peritoneal opening is enlarged laterally by stretching and a careful exploration made of the uterine fundus and adnexæ. Adhesions must be separated and neoplasms delivered and removed.

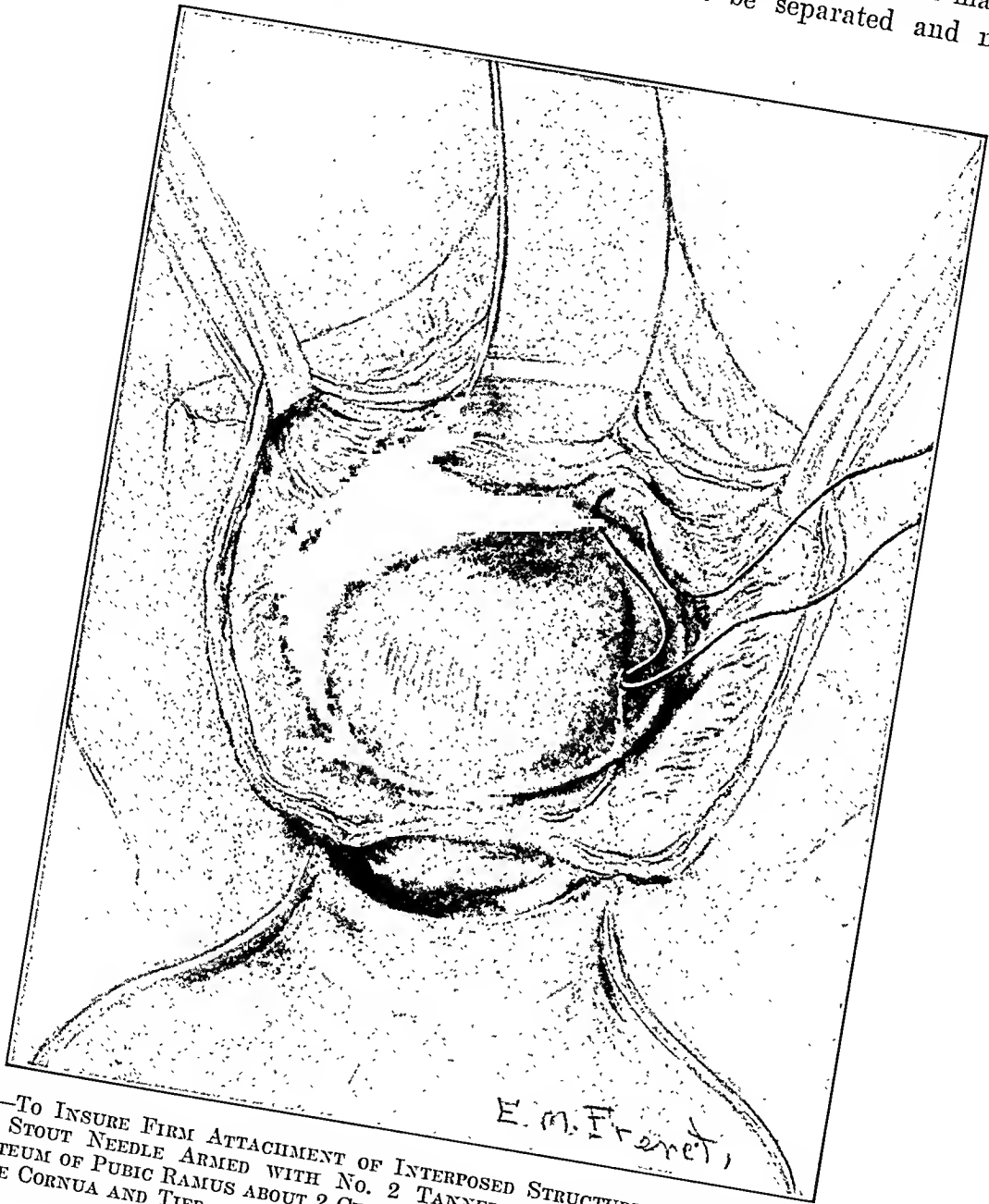


FIG. 253.—TO INSURE FIRM ATTACHMENT OF INTERPOSED STRUCTURES TO SUBPUBIC ARCH, A SHORT STOUT NEEDLE ARMED WITH NO. 2 TANNED OR CHROMIC GUT IS PASSED INTO PERIOSTEUM OF PUBIC RAMUS ABOUT 2 CENTIMETERS TO ONE SIDE OF MIDLINE AND THROUGH UTERINE CORNUA AND TIED.

The uterine fundus is now delivered through the vagina by anteverting it with a series of traction sutures placed successively, creeping up the anterior surface; an instrument we have devised called a cat's-paw tenaculum is useful for this purpose, Figure 251. The broad spatula on the back of the hooks is to lift up the bladder and protect it from the sharp hooks, while catching the

surface of the fundus. A pair of these tenacula is used to climb up the anterior surface of the uterus and to deliver it. The fundus uteri is next drawn sharply downward and the edge of the bladder peritoneum fastened to the posterior surface of the uterus with the suture previously placed, thus closing the abdominal cavity, Figure 252.

A firm attachment of the interposed structures to the subpubic arch is accomplished by passing a short stout needle armed with No. 2 tanned or chromic gut into the periosteum of the pubic ramus about 2 centimeters to one

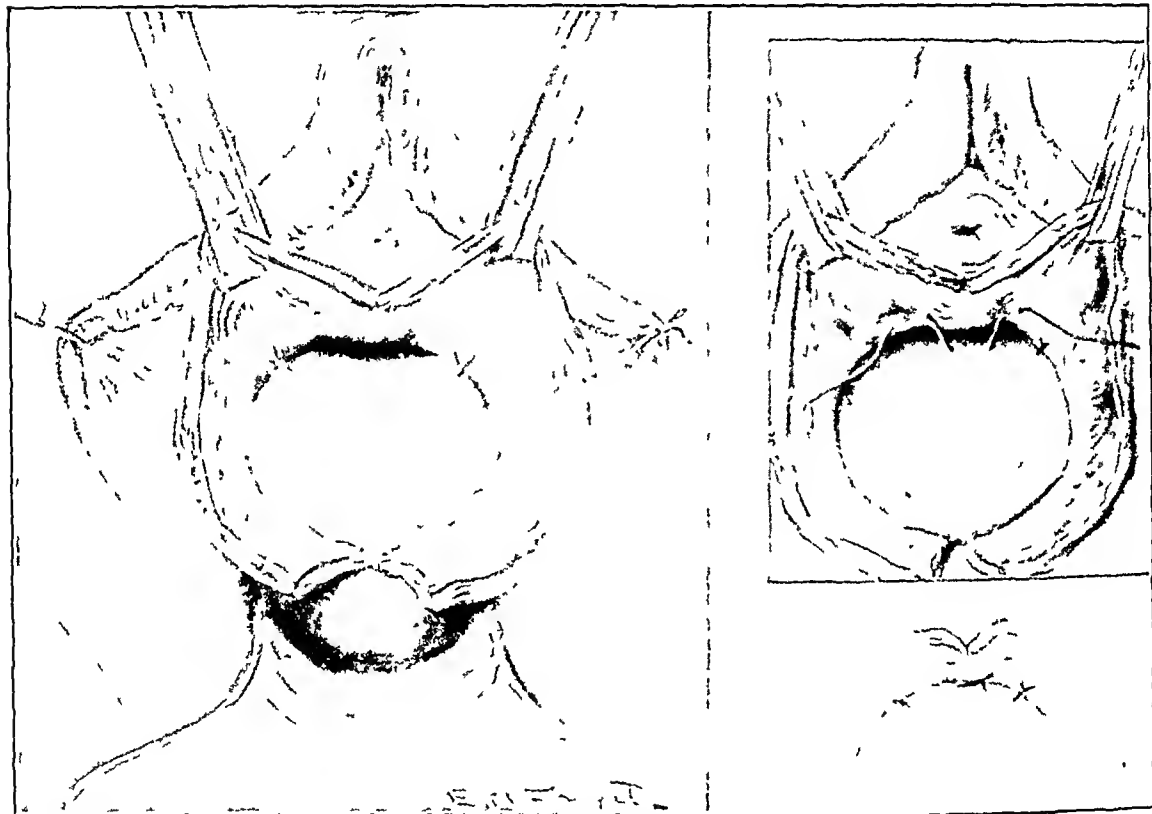


FIG. 254.—FUNDUS OF UTERUS FASTENED WITH SUTURE TO EACH SIDE OF SUBPUBIC ARCH, CARE BEING TAKEN THAT SUTURE INCLUDES PERIOSTEUM.

A third suture is placed as shown to close space in midline, and is important to prevent prolapse of urethra and bladder.

side of the midline of the symphysis; the suture passes through the uterine cornu and is tied, Figure 253. A similar suture fixes the other side. It is important to place a third suture in the midline, catching the tissues on both sides of the urethra and the midline of the uterus, thus preventing a prolapse of the urethra and even of the bladder in the midline over the uterine fundus, Figure 254. After the fundus has been anchored to the subpubic arch, the vaginal incision is closed with interrupted catgut sutures, including the uterine wall in the sutures, Figure 255.

Experience has demonstrated the wisdom of an outlet for any oozing of blood which may persist after extensive dissections in this location; temporary

drainage is provided by inserting a rubber tissue drain in the line of the incision and extending up on each side between the bladder and vaginal wall. A linen thread is attached to the strip of rubber tissue in its center thus making a Y and a small roll of iodoform gauze tied to the other end. This

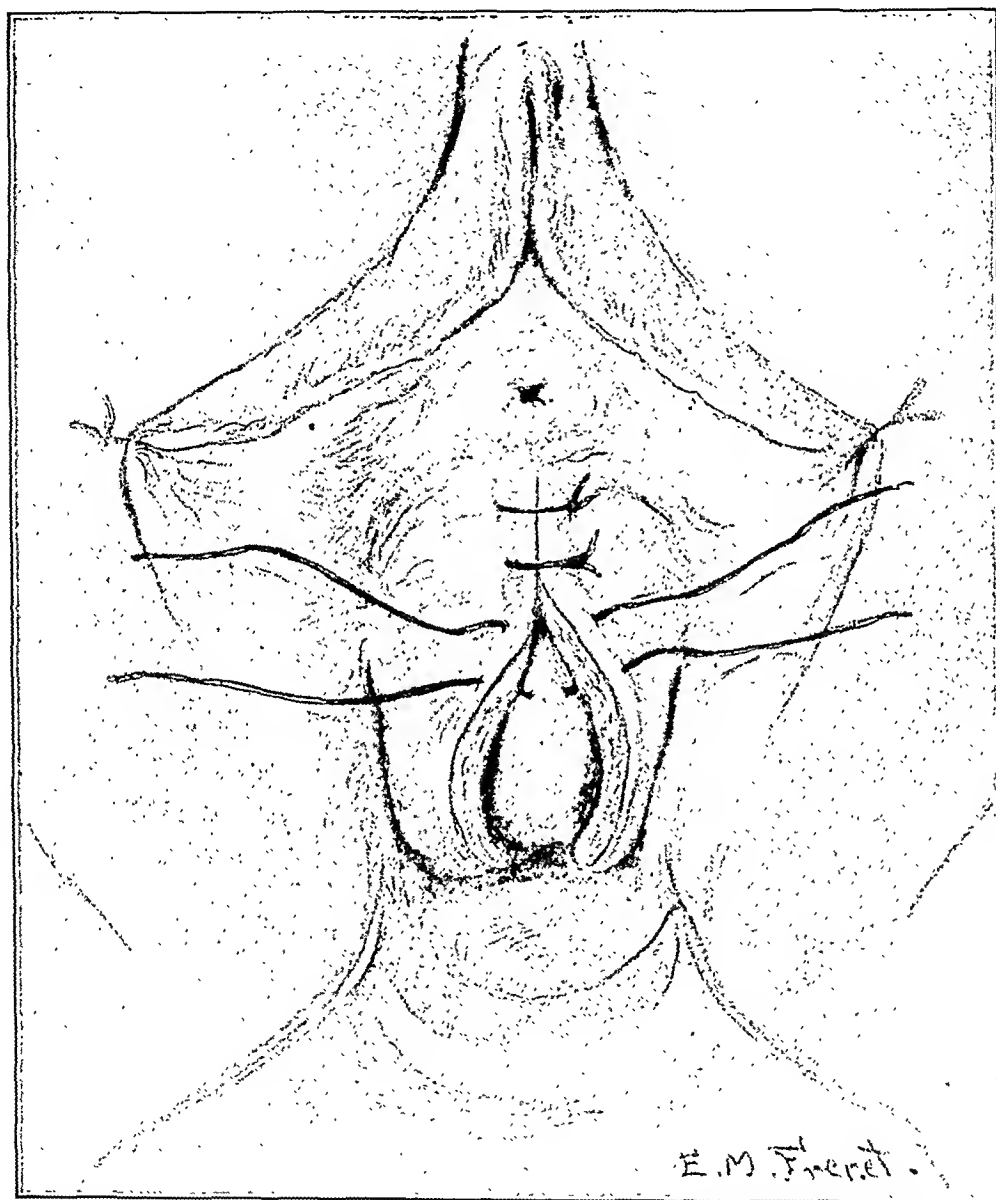


FIG. 255.—VAGINAL INCISION CLOSED WITH INTERRUPTED CATGUT SUTURES WHICH INCLUDE UTERINE WALL.

Y drain is inserted as shown in Figure 256 and the roll of gauze tucked into the vagina where it can be readily picked up with a thumb forceps and removed after forty-eight hours. Thus, troublesome hematmata and infections are prevented.

The operation is completed by repair of the relaxed or lacerated pelvic floor in accordance with the technique described in the following chapter.

Figure 257 gives a view of the completed interposition operation in sagittal section.

Modified Mayo Operation for Complete Prolapsed Uterus.—This technique gives the best results in marked or complete prolapse of the uterus. A sufficient elongation of the broad ligaments is necessary to carry out the principle of the operation effectively. We have modified the operation as devised by Charles Mayo, mainly in resecting Douglas's pouch and

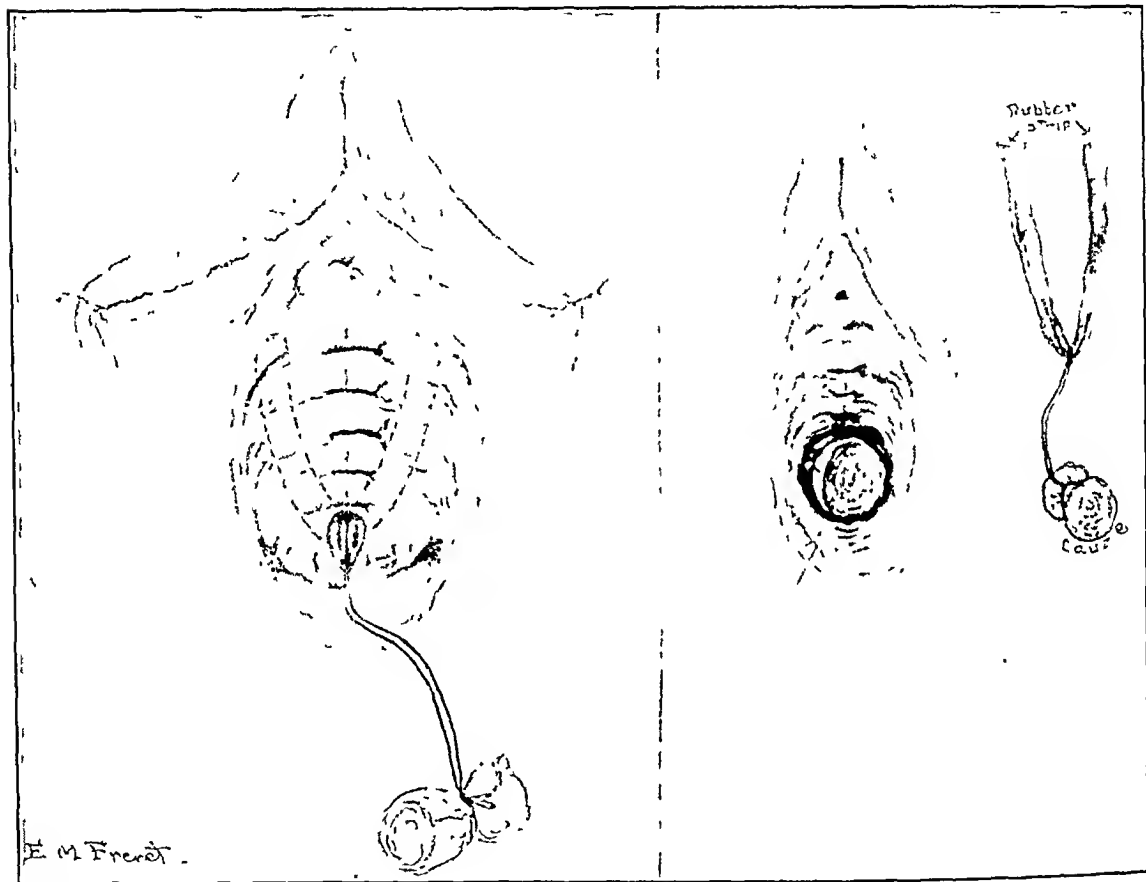


FIG. 256.—VAGINAL INCISION CLOSED AND Y-SHAPED DRAIN MADE OF RUBBER TISSUE TIED TO SMALL ROLL OF IODOFORM GAUZE INSERTED AS SHOWN TO DRAIN OOZING BLOOD, TO BE REMOVED AFTER FORTY-EIGHT HOURS.

suturing the uterosacral ligaments to prevent the development of an enterocele, as well as in the firm anchorage of the united broad ligaments to the periosteum of the subpubic arch.

Both lips of the cervix are grasped firmly with a pair of Jacobs forceps and a sound passed into the bladder to define its exact relation to the external os. The vaginal tissue at the base of the urethra is picked up in the midline with an Allis clamp and the tissues put on the stretch.

A scalpel is used to outline the incision shown in Figure 258, and the flap of vaginal wall is dissected downward off the base of the bladder to the cervix. The vaginal flaps with the attached fascia are dissected laterally out

to the broad ligaments with blunt scissors and the gauze-covered finger—not difficult when once the line of cleavage is established, Figure 259. The cervix is drawn sharply upward and the vaginal attachment separated from it and dissected upward and the peritoneum opened, giving access to

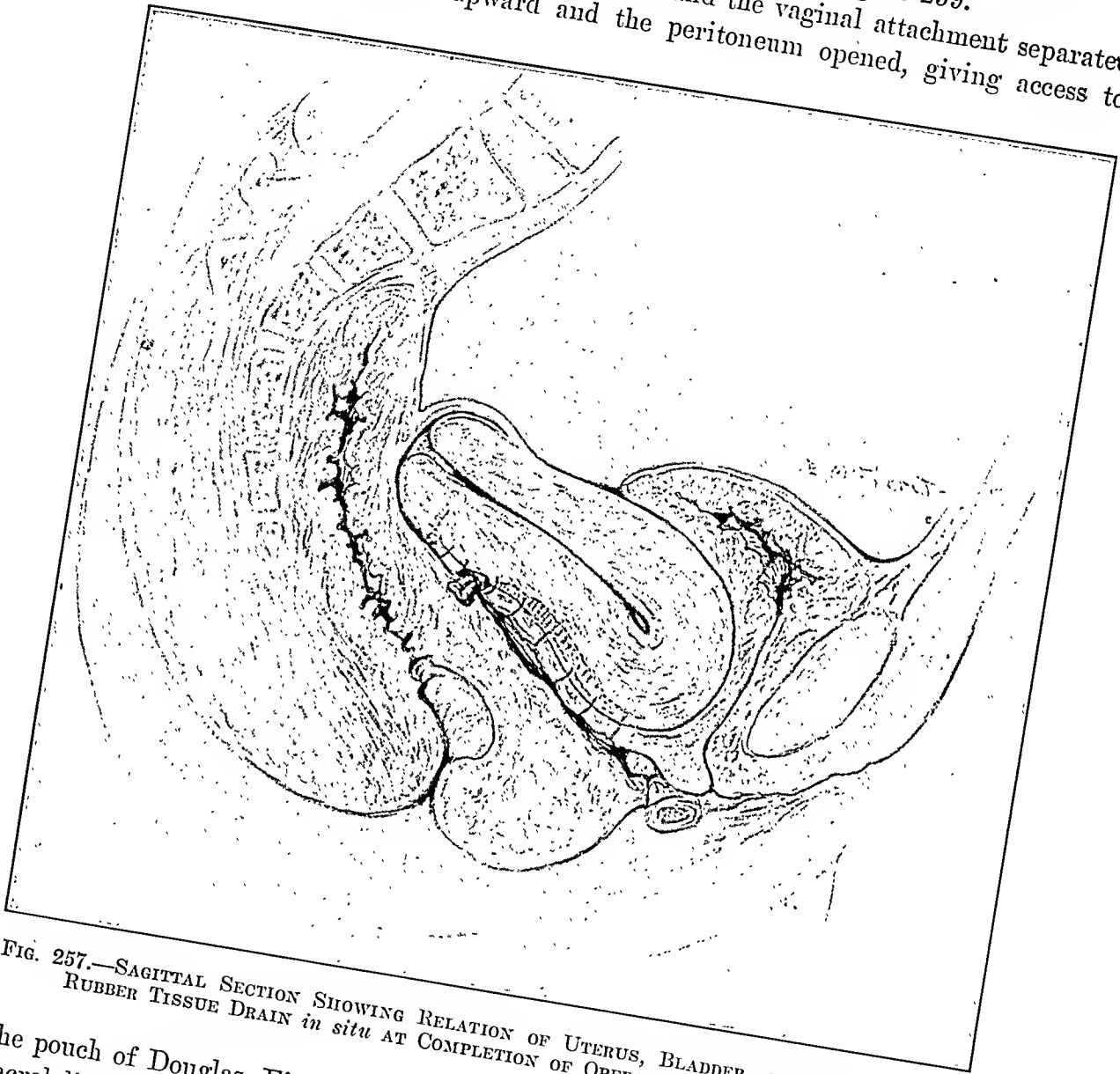


FIG. 257.—SAGITTAL SECTION SHOWING RELATION OF UTERUS, BLADDER, AND VAGINA WITH RUBBER TISSUE DRAIN *in situ* AT COMPLETION OF OPERATION OF INTERPOSITION.

the pouch of Douglas, Figure 260. Traction on the cervix develops the utero-sacral ligaments and a clamp is placed on each to insure identification at a later stage, Figure 261.

The bladder is separated from the uterus by blunt dissection with the gauze-covered finger until the peritoneum is reached, Figure 262, which is opened with scissors and stretched wide and a long suture passed through the bladder reflection and clamped, Figure 263, and placed out of the way over the symphysis until needed later. This procedure prevents losing the cut edge of the peritoneum.

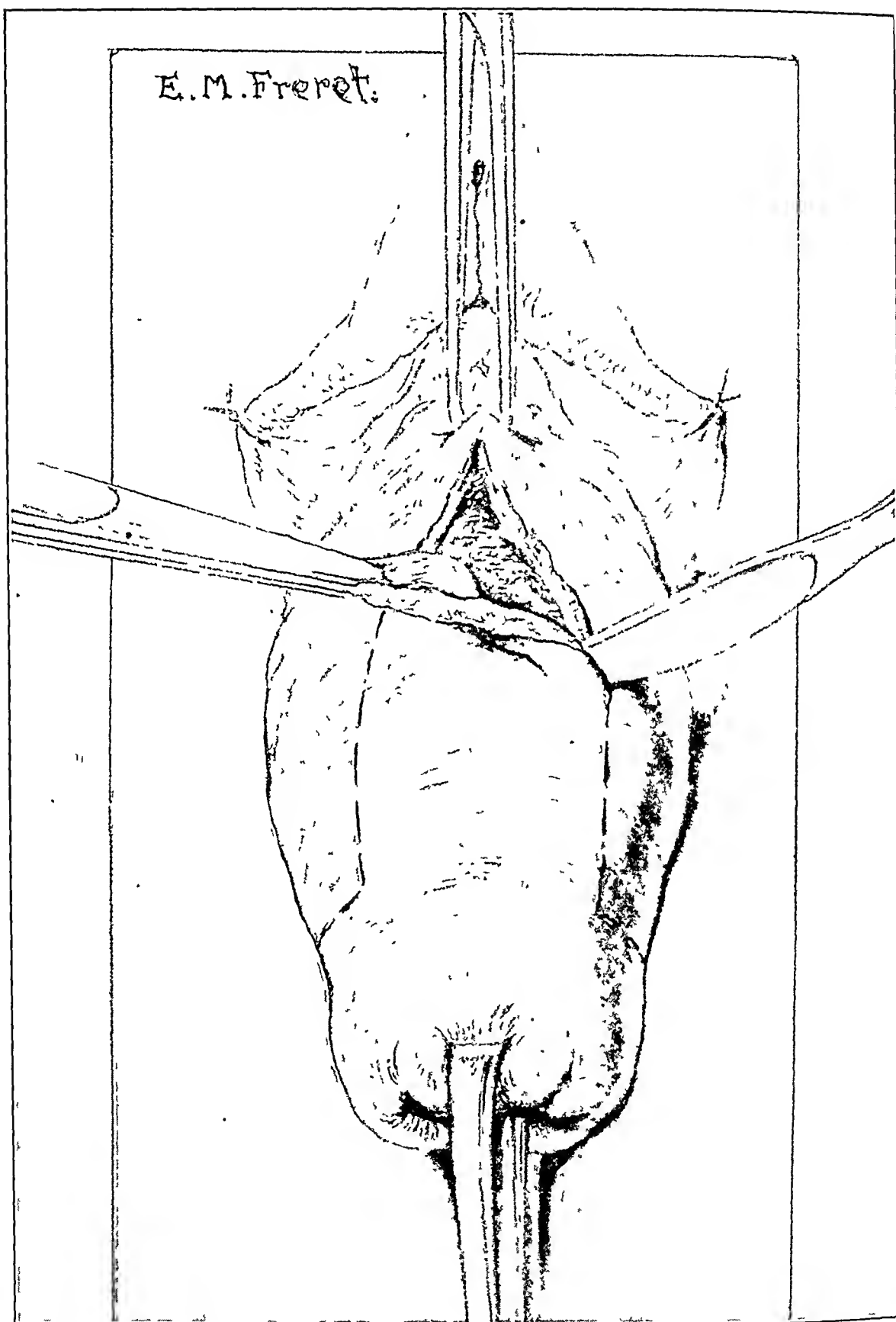


FIG. 258.—SCALPEL USED TO OUTLINE INCISION; FLAP OF VAGINAL WALL DISSECTED DOWNWARD OFF BASE OF BLADDER TO CERVIX.

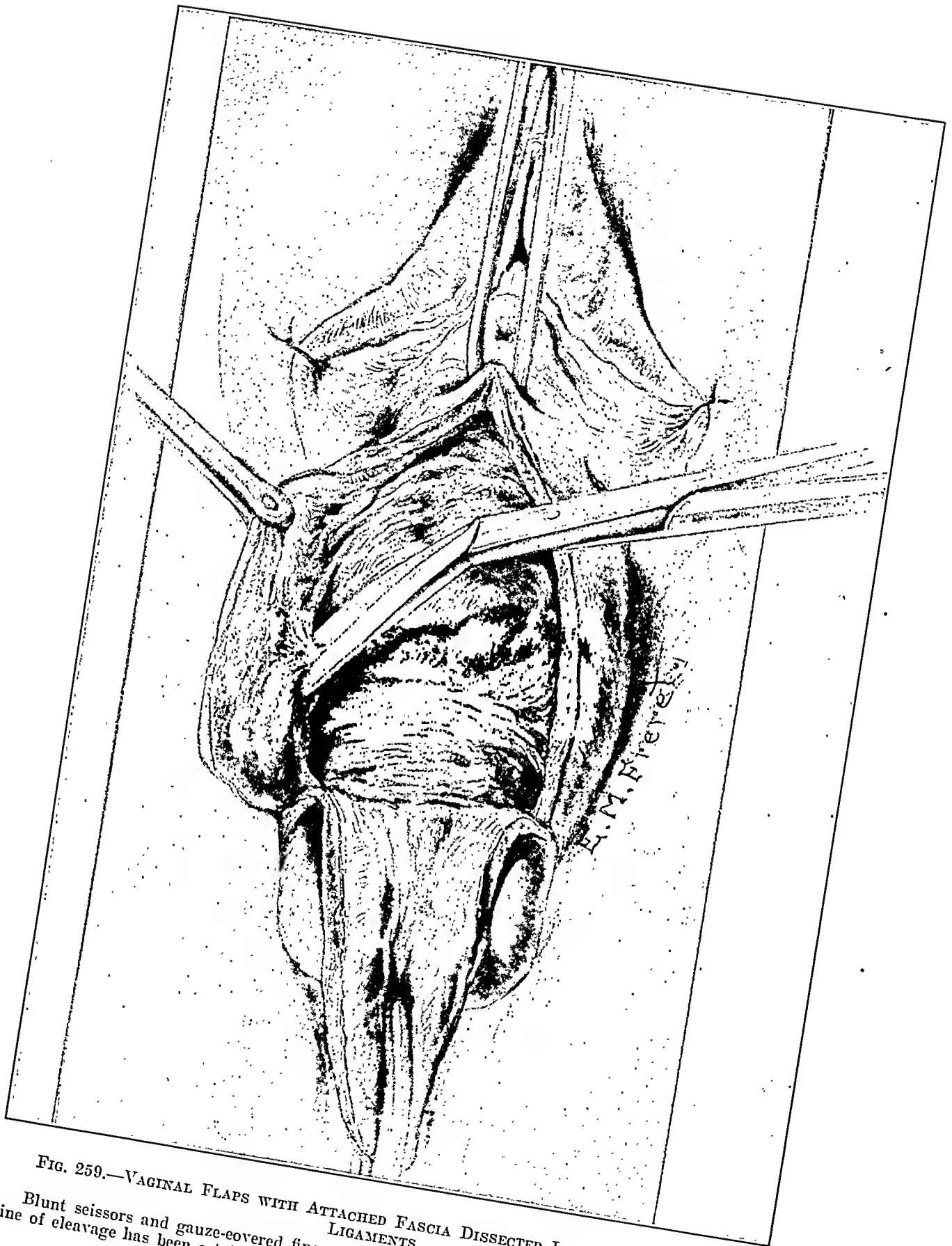


FIG. 259.—VAGINAL FLAPS WITH ATTACHED FASCIA DISSECTED Laterally to Broad Ligaments.

Blunt seissors and gauze-covered finger used in this dissection which is not difficult when line of cleavage has been established.

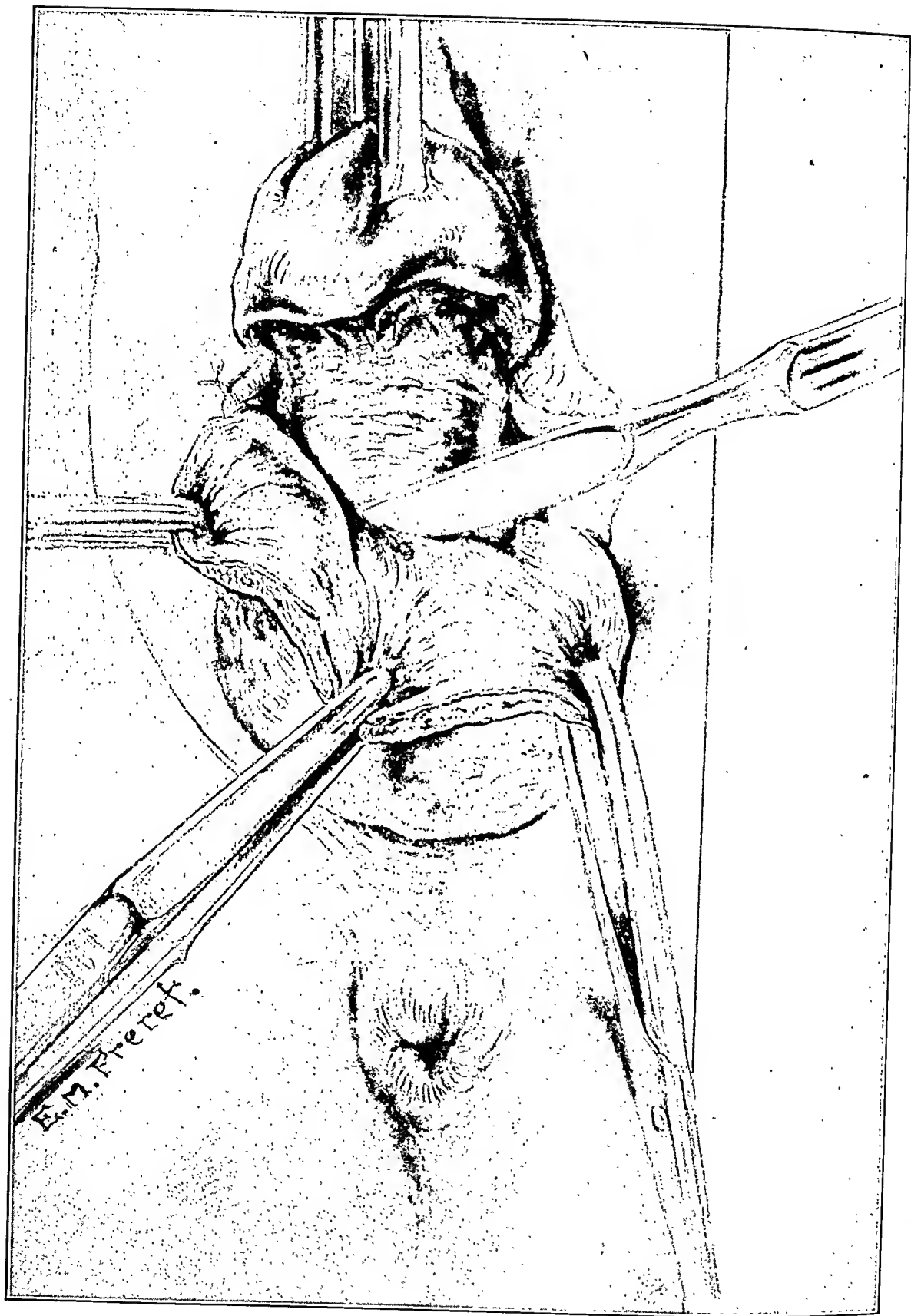


FIG. 260.—CERVIX DRAWN SHARPLY UPWARD; VAGINAL ATTACHMENT SEPARATED FROM CERVIX AND DISSECTED UPWARD; PERITONEUM OPENED, GIVING ACCESS TO POUCH OF DOUGLAS.

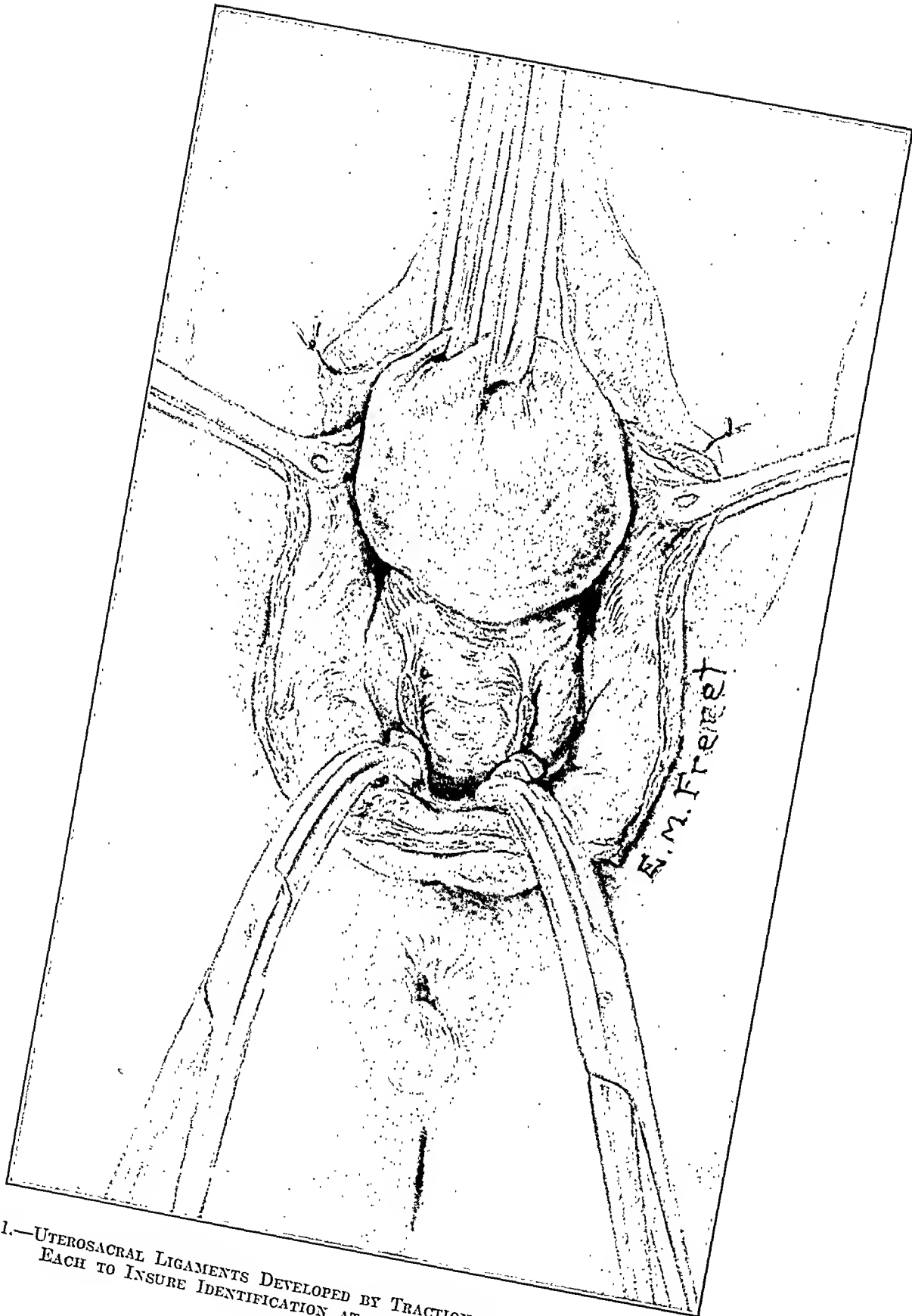


FIG. 261.—UTEROSACRAL LIGAMENTS DEVELOPED BY TRACTION ON CERVIX; CLAMP PLACED ON EACH TO INSURE IDENTIFICATION AT A LATER STAGE IN OPERATION.

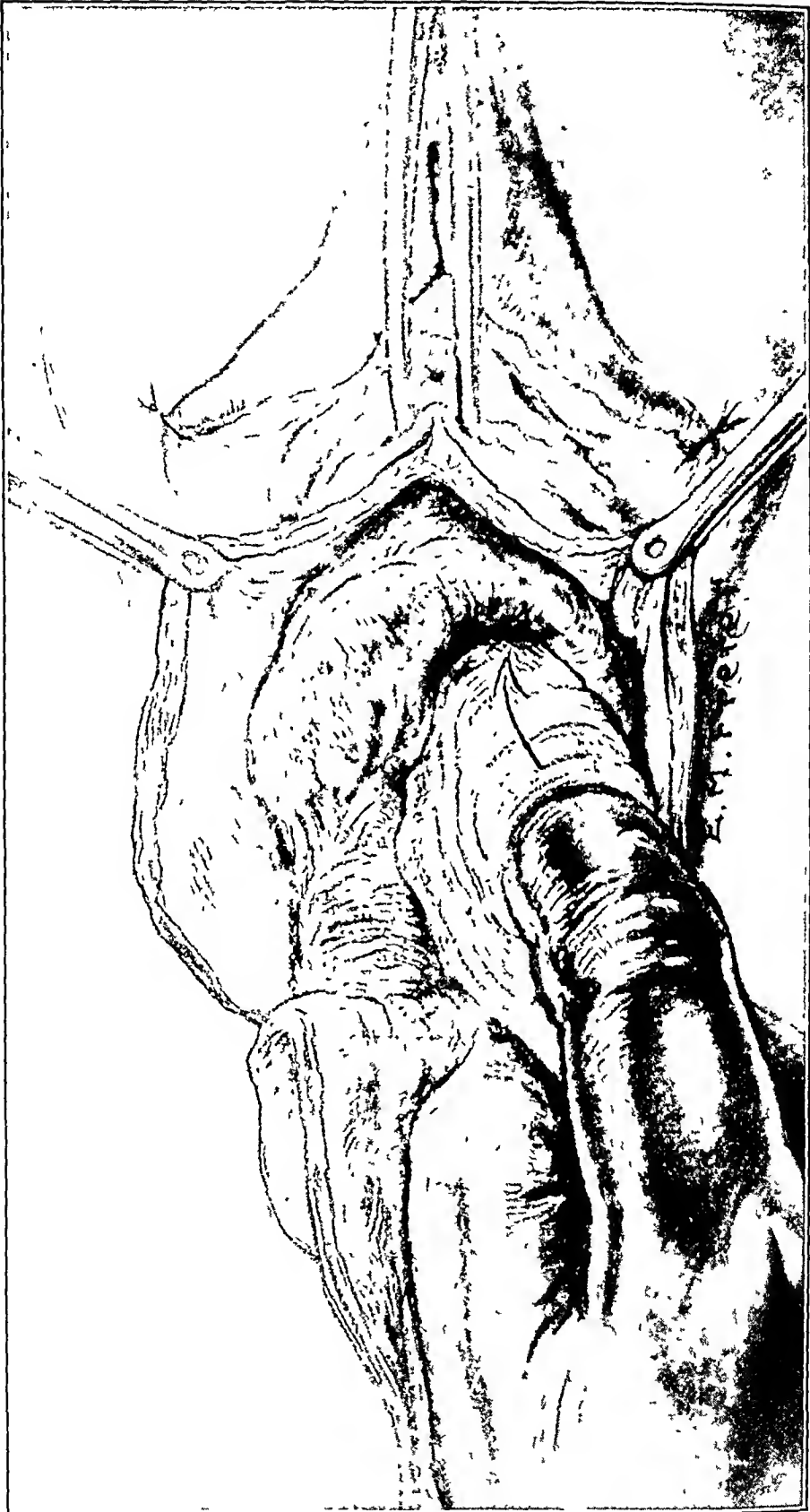


FIG. 262.—BLADDER SEPARATED FROM UTERUS BY BLUNT DISSECTION WITH GAUZE-COVERED FINGER UNTIL PERITONEUM IS REACHED.

A careful examination of the pelvis is made to ascertain the condition of the uterine fundus and adnexæ and the presence of adhesions which are dealt with accordingly.

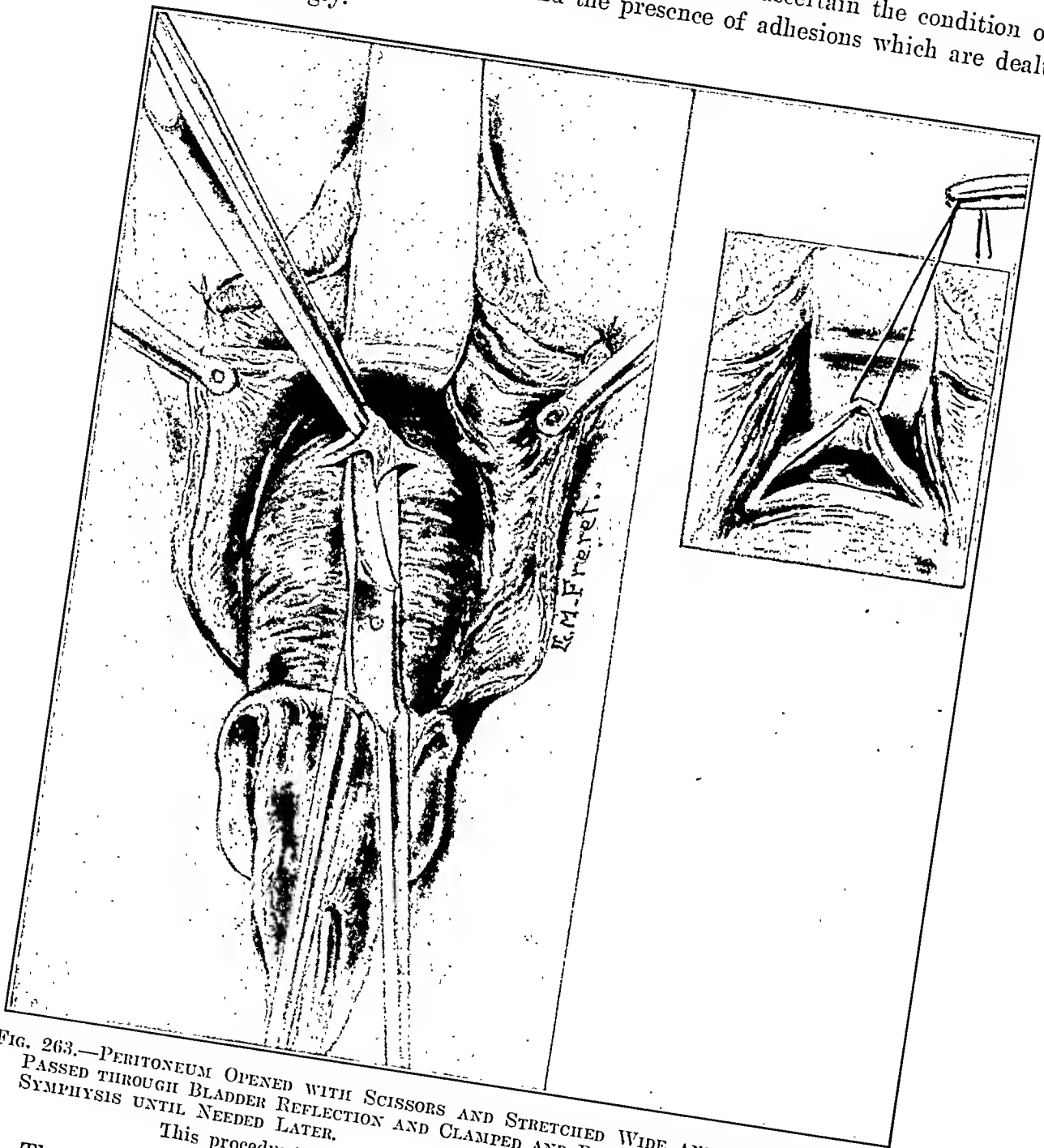


FIG. 263.—PERITONEUM OPENED WITH SCISSORS AND STRETCHED WIDE AND A LONG SUTURE PASSED THROUGH BLADDER REFLECTION AND CLAMPED AND PLACED OUT OF THE WAY OVER SYMPHYSIS UNTIL NEEDED LATER.
This procedure prevents loss of cut edge of peritoneum.

The uterine fundus is next delivered by successive sutures or by the cat-paw tenacula as described in the Watkins technique, Figure 264.
A heavy Ochsner-Mayo or Kocher clamp is placed across the top of the left broad ligament close to the uterus, which is cut away with scissors down to the tip of the clamp, Figure 265. A second clamp placed in front of the first

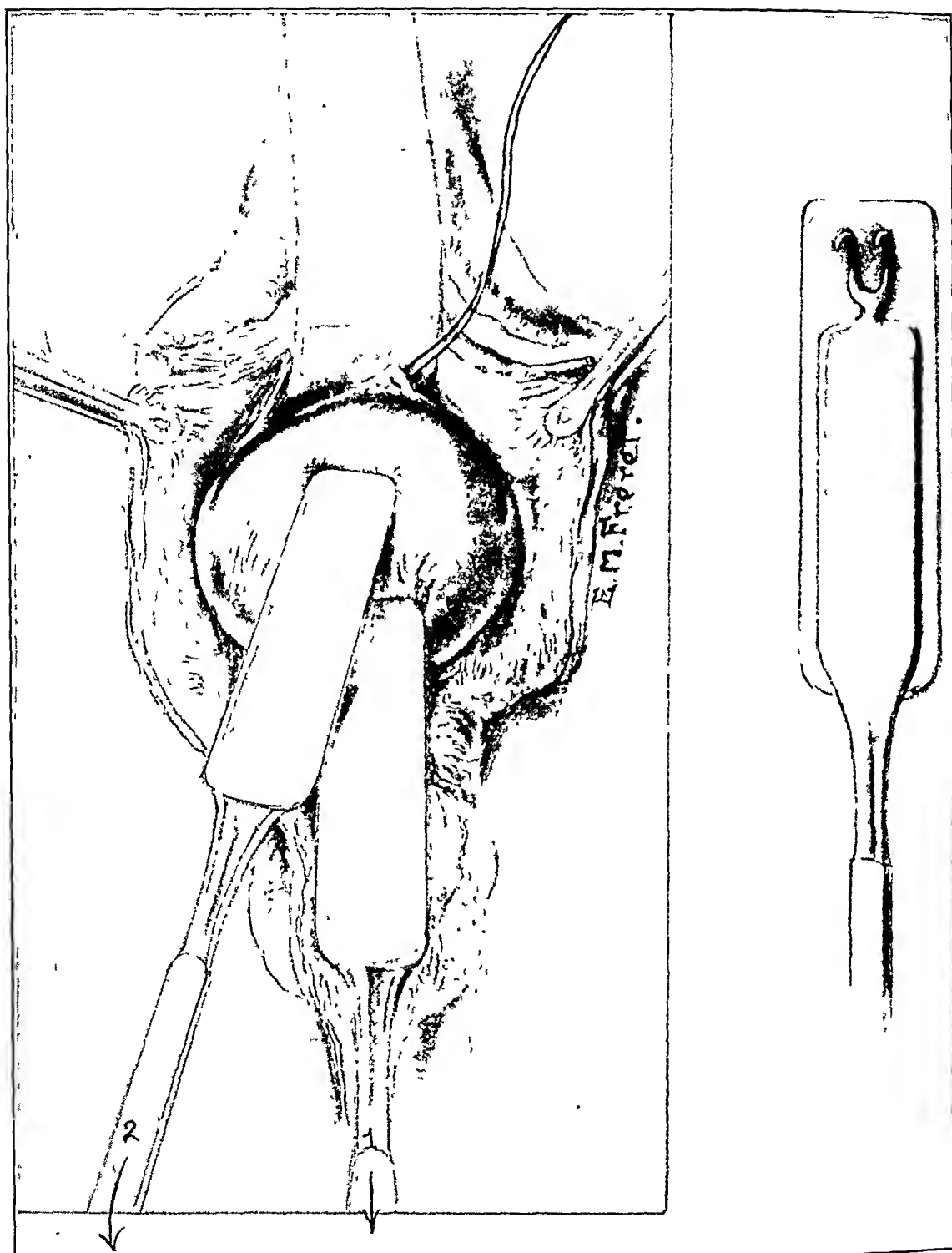


FIG. 264.—UTERINE FUNDUS DELIVERED BY SUCCESSIVE SUTURES OR BY CAT'S-PAW TENACULA AS DESCRIBED IN THE WATKINS TECHNIQUE.

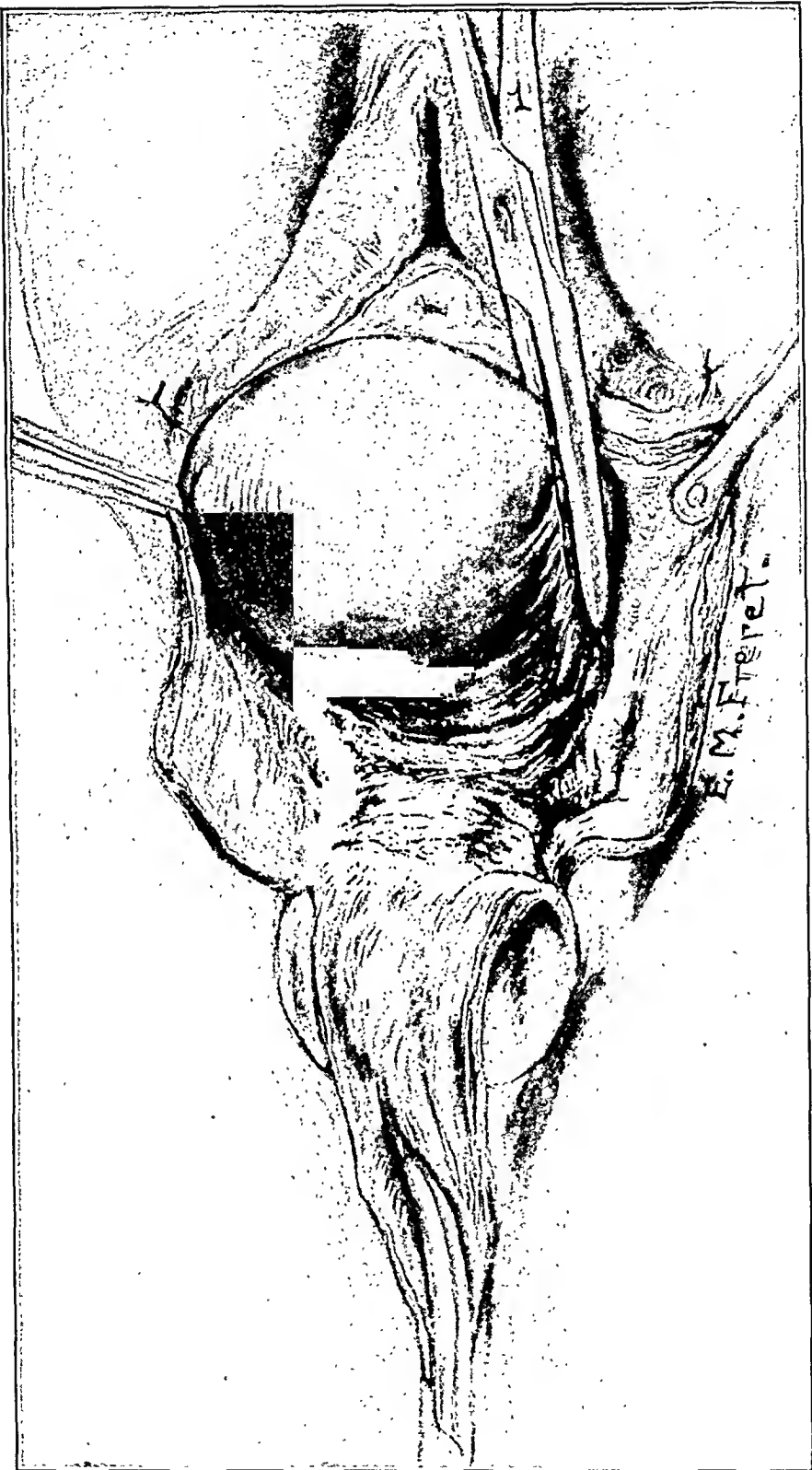


FIG. 265.—HEAVY OCHSNER-MAYO OR KOCHER CLAMP PLACED ACROSS TOP OF LEFT BROAD LIGAMENT CLOSE TO UTERUS WHICH IS CUT AWAY WITH SCISSORS DOWN TO TIP OF CLAMP.

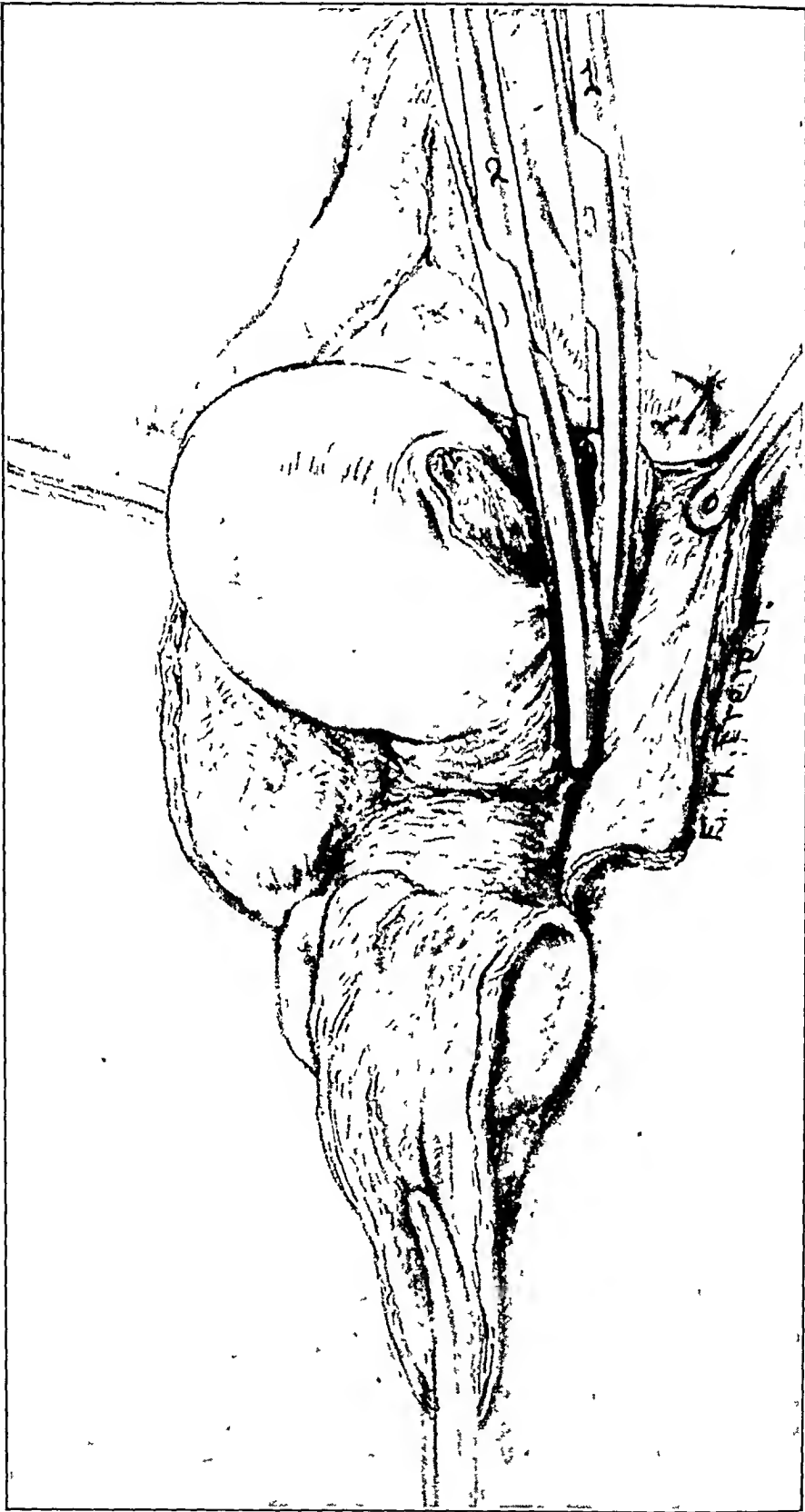


FIG. 266.—SECOND CLAMP PLACED IN FRONT OF FIRST, GRASPING BROAD LIGAMENT IN THE SAME MANNER.

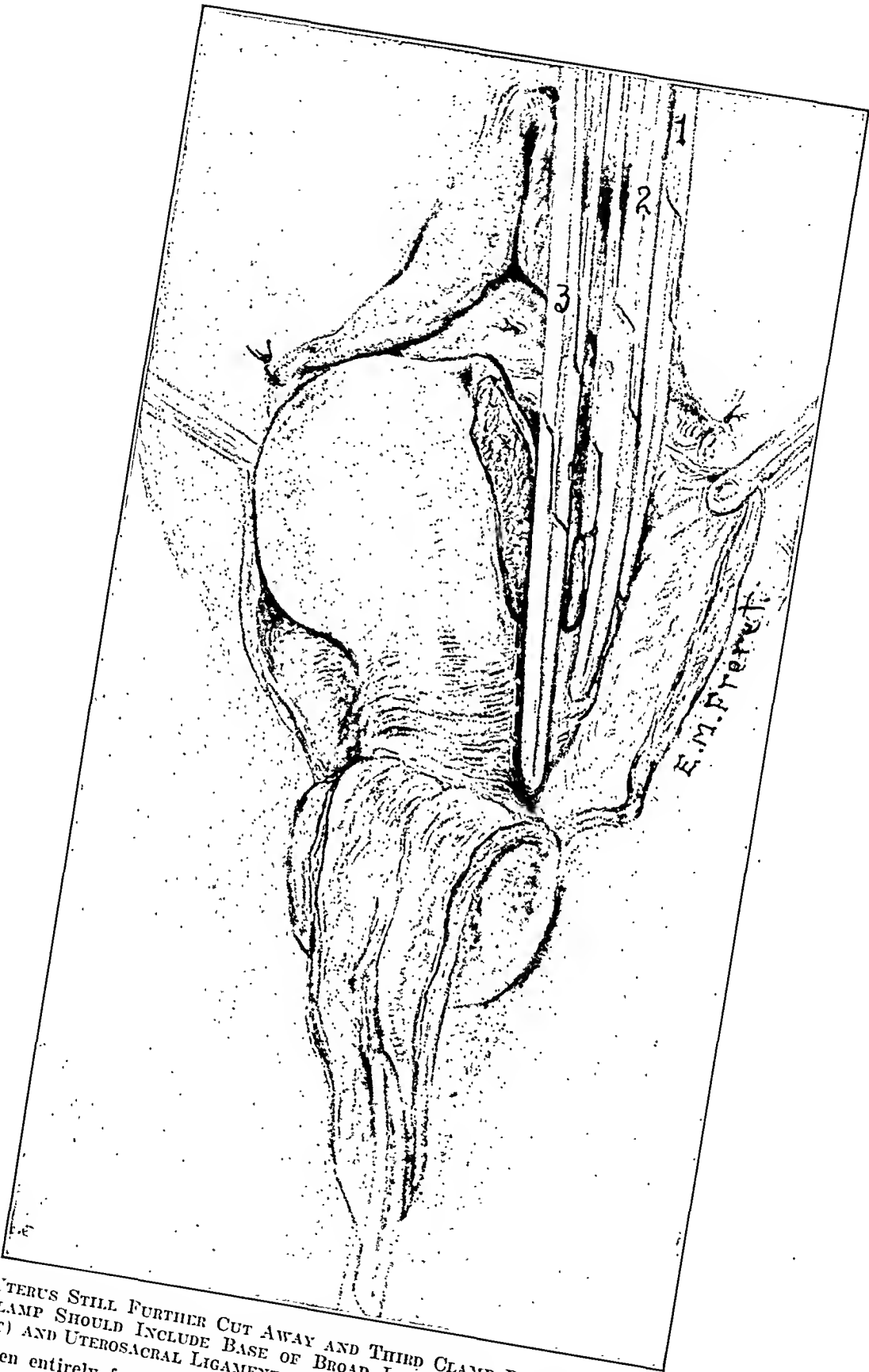


FIG. 267.—UTERUS STILL FURTHER CUT AWAY AND THIRD CLAMP PLACED; THE TIP OF THIS THIRD CLAMP SHOULD INCLUDE BASE OF BROAD LIGAMENT (CARDINAL OR MACKENRODT LIGAMENT) AND UTEROSACRAL LIGAMENT.
 Uterus then entirely freed from left broad ligament; same procedure followed on other side; uterus removed.

grasps the broad ligament in the same manner, Figure 266. The uterus is still further cut away and a third clamp placed, the tip including the base of the broad ligament (the cardinal or Mackenrodt's ligament) and the utero-

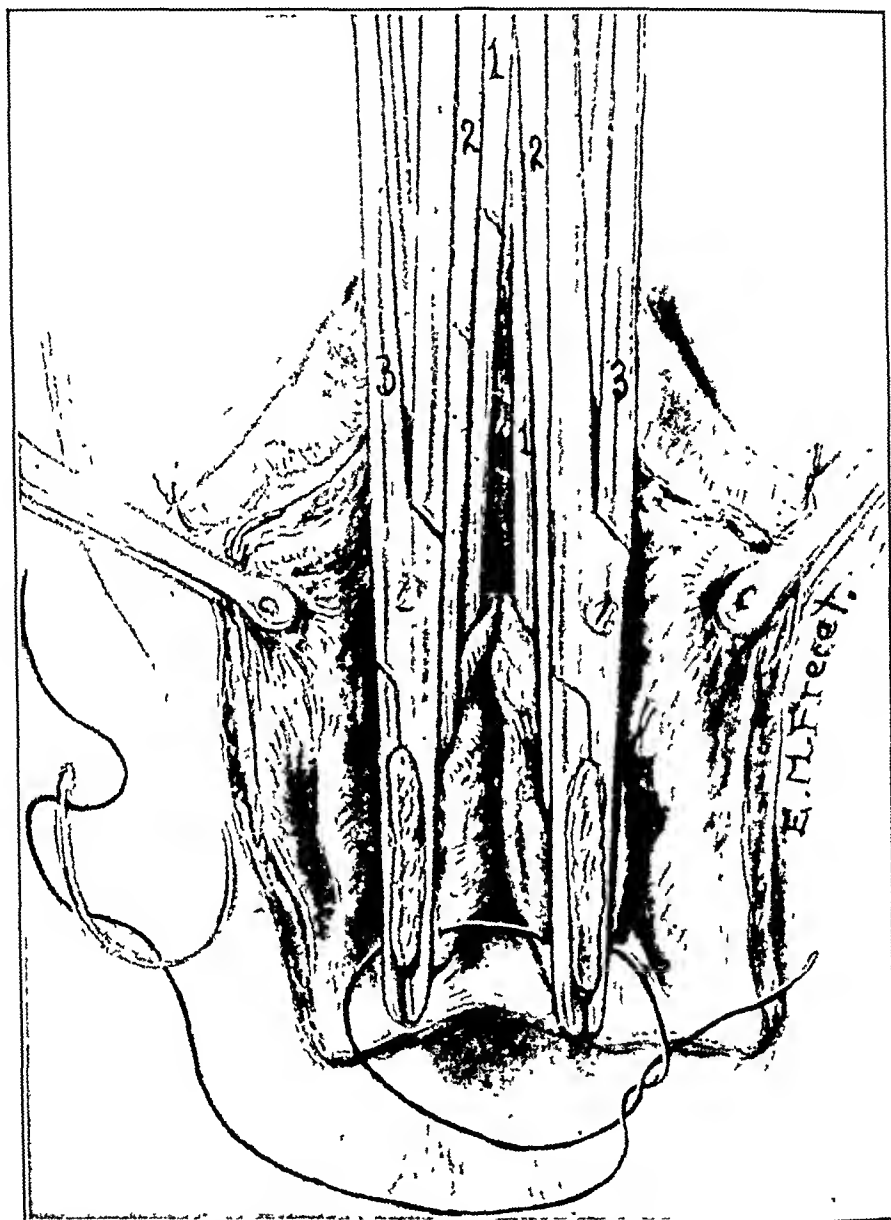


FIG. 268.—POUCH OF DOUGLAS NEXT OBLITERATED ACCORDING TO TECHNIQUE FOR ENTEROCELE (CHAP. XX) AND THE SIX CLAMPS BROUGHT TOGETHER IN A PARALLEL POSITION AND THE CUT ENDS OF LIGAMENTS UNITED BY SUTURE.

A long tanned or chromic gut suture on a round-pointed, curved needle fastened at base of ligaments at site of tip of last pair of clamps.

sacral ligament. The uterus is then entirely freed from the left broad ligament, Figure 267.

This procedure is carried out on the other side and the uterus removed.

We now have both broad ligaments, including the tubes, round ligaments, and uterosacral ligaments in the grasp of the clamps with the pouch of Douglas lying between and within easy reach. The peritoneum of this pouch is then

dissected out up to the uterosacral ligaments and cut away and the uterosacral ligaments brought into view by traction on the forceps previously placed upon them. Interrupted sutures of Pagenstecher linen are now passed to unite

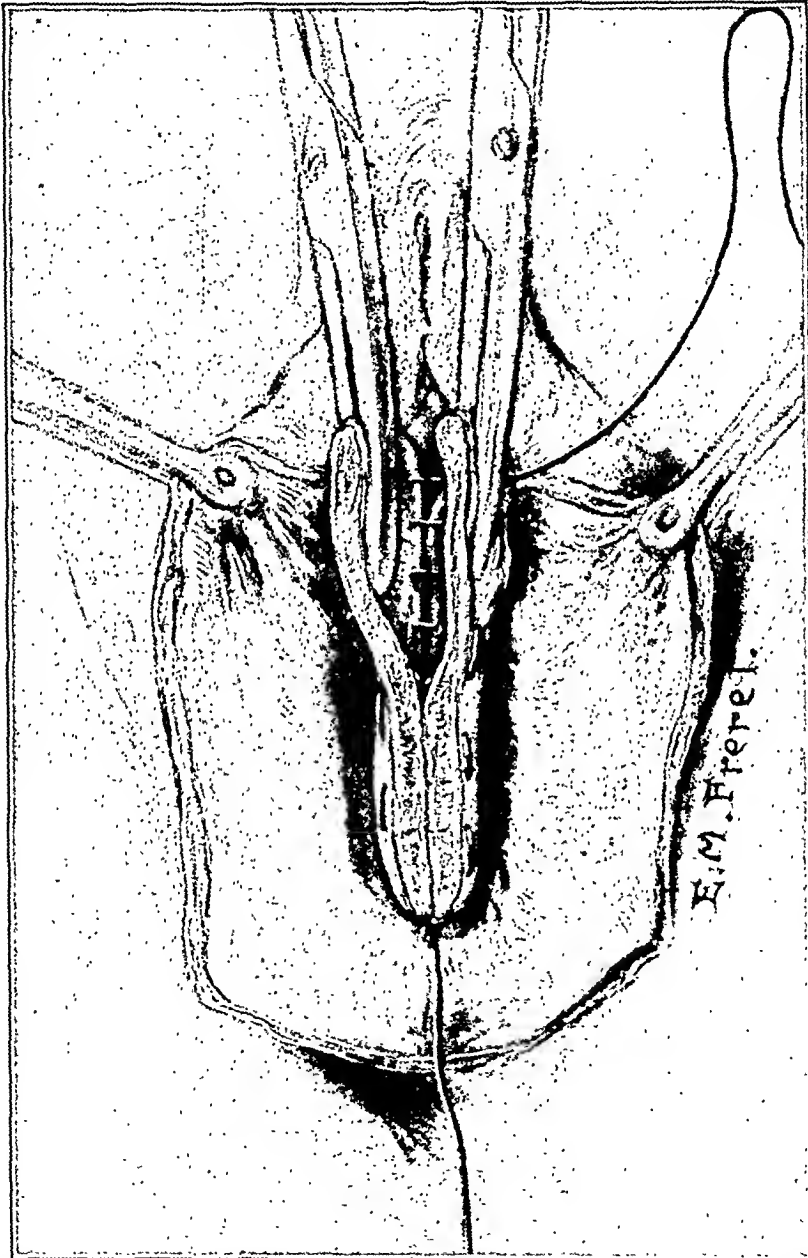


FIG. 269.—CONTINUOUS MATTRESS-SUTURE PASSED GOING THROUGH AND THROUGH ENTIRE THICKNESS OF LIGAMENTS BEHIND CLAMPS REMOVED SUCCESSIVELY AS SUTURE IS PASSED.

them as far up as the rectum, Figure 296, Chapter XX. Thus the tendency toward hernia in this pouch of Douglas (enterocele), not infrequently seen, which will mar an otherwise satisfactory result, is obviated (Chapter XX).

After the pouch of Douglas has been obliterated the six clamps are brought together in a parallel position and the cut ends of the ligaments united by suture as follows:

A long No. 2 tanned or chromic gut suture on a round-pointed, good-sized, curved needle is used. This is fastened at the bases of the ligaments at the site of the tip of the last pair of clamps, Figure 268, and passed as a con-

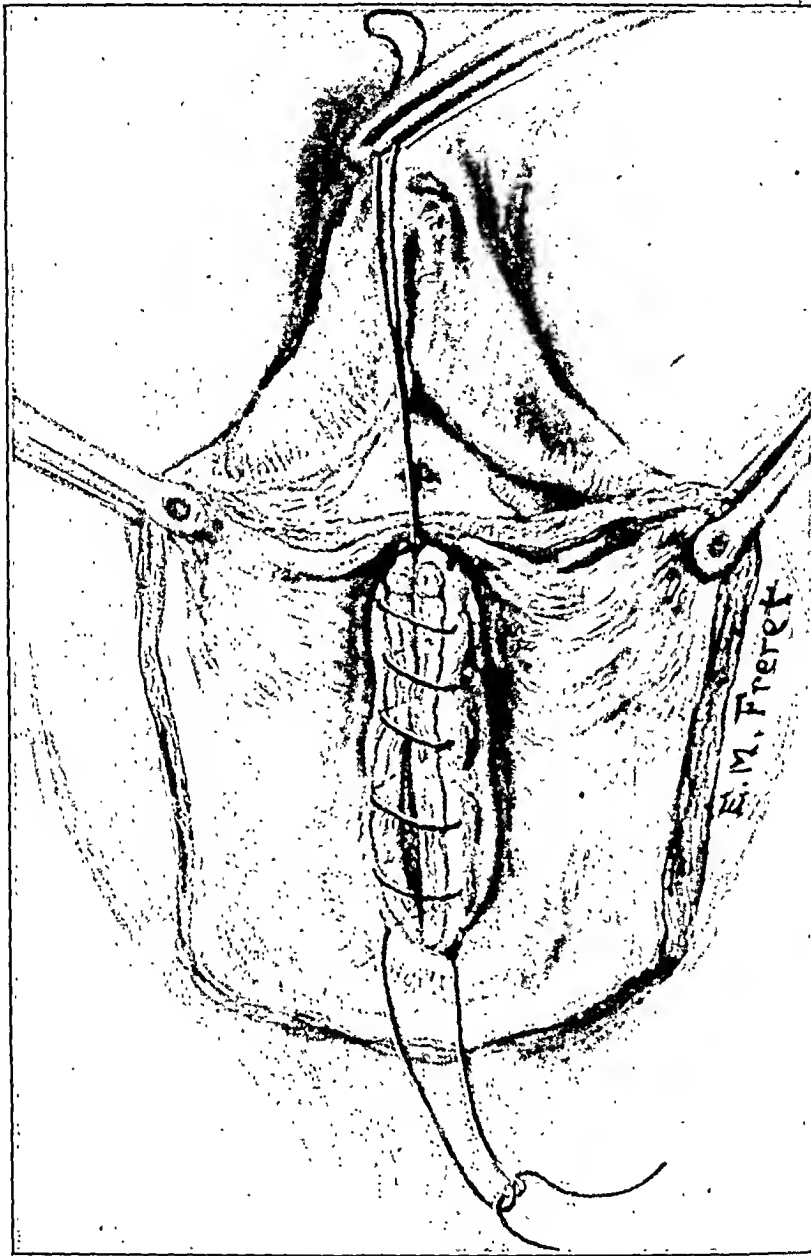


FIG. 270.—SUTURE TIED SECURELY AT TOP OF LIGAMENTS, LOOP BEING LEFT FOR TRACTION UPWARD, WHILE SAME SUTURE IS CONTINUED DOWNWARD AS A LOCKSTITCH, UNITING CUT EDGES OF LIGAMENTS AND IS TIED TO END LEFT AT START OF SUTURE.

tinuous mattress-suture going through and through the entire thickness of the ligaments behind the clamps, which are removed successively as the suture is passed, Figure 269. The suture is then securely tied at the top of the ligaments and a loop left for traction upward, while the same suture is continued downward as a lockstitch uniting the cut edges of the ligaments to be tied finally to the end left at the start of the suture, Figure 270.

The suture that was passed through the cut edge of the reflection of the bladder peritoneum on opening the peritoneal cavity is then used to attach this peritoneal opening to the posterior surface of the united ligaments, closing peritoneal opening to the posterior surface of the united ligaments, closing

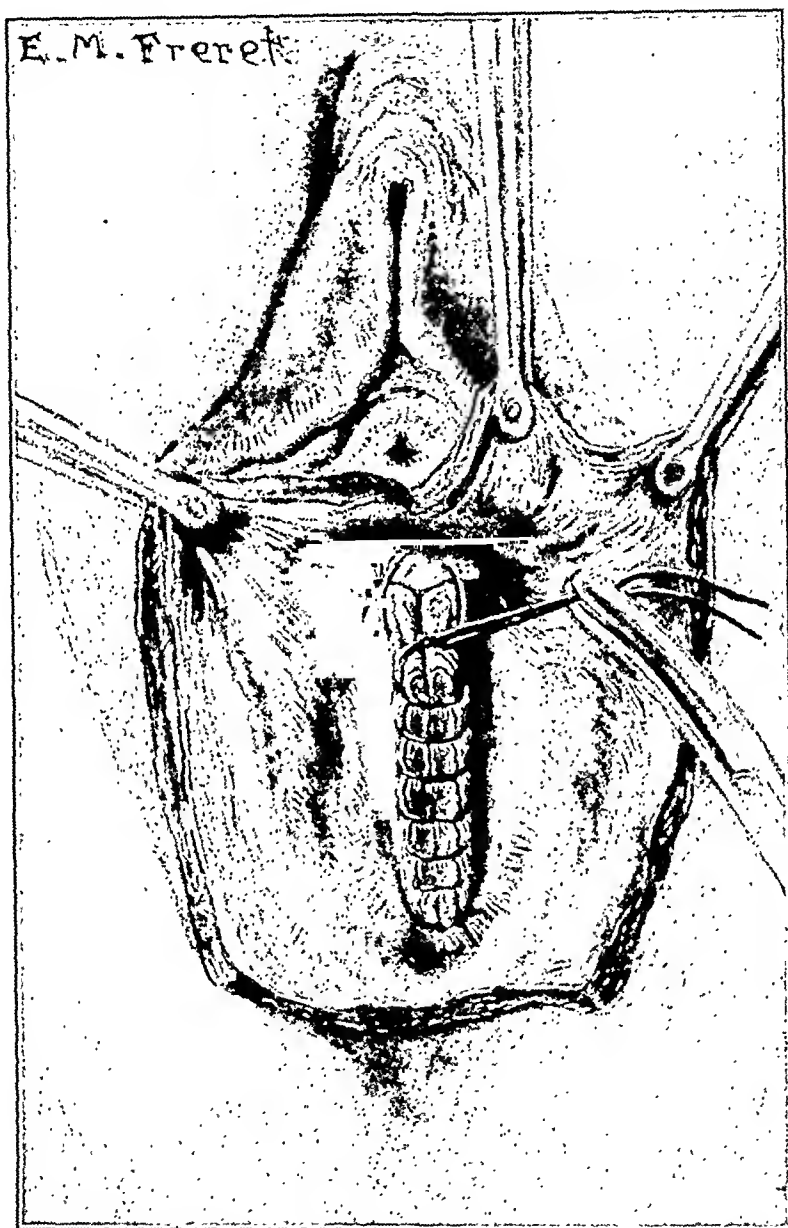


FIG. 271.—SUTURE PREVIOUSLY PASSED THROUGH CUT EDGE OF REFLECTION OF BLADDER PERITONEUM ON OPENING PERITONEAL CAVITY IS USED TO ATTACH THIS PERITONEAL OPENING TO POSTERIOR SURFACE OF UNITED LIGAMENTS, THUS CLOSING ABDOMINAL CAVITY, WITH BLADDER ENTIRELY REPLACED IN PELVIS.

the abdominal cavity, the bladder being now entirely replaced in the pelvis, Figure 271.

The anchorage of the united ligaments to the subpubic arch is next effected in a manner similar to that described in the modified Watkins technique. A short, stout, round-pointed, curved needle, armed with No. 2 tanned or chromic gut, is passed into the periosteum of the pubic ramus about 2 centimeters to

one side of the midline of the symphysis, and then through the top of one-half of the united ligaments, and tied, being certain that the bladder wall is pushed well up and is not caught in the tying, Figure 272. The other side is

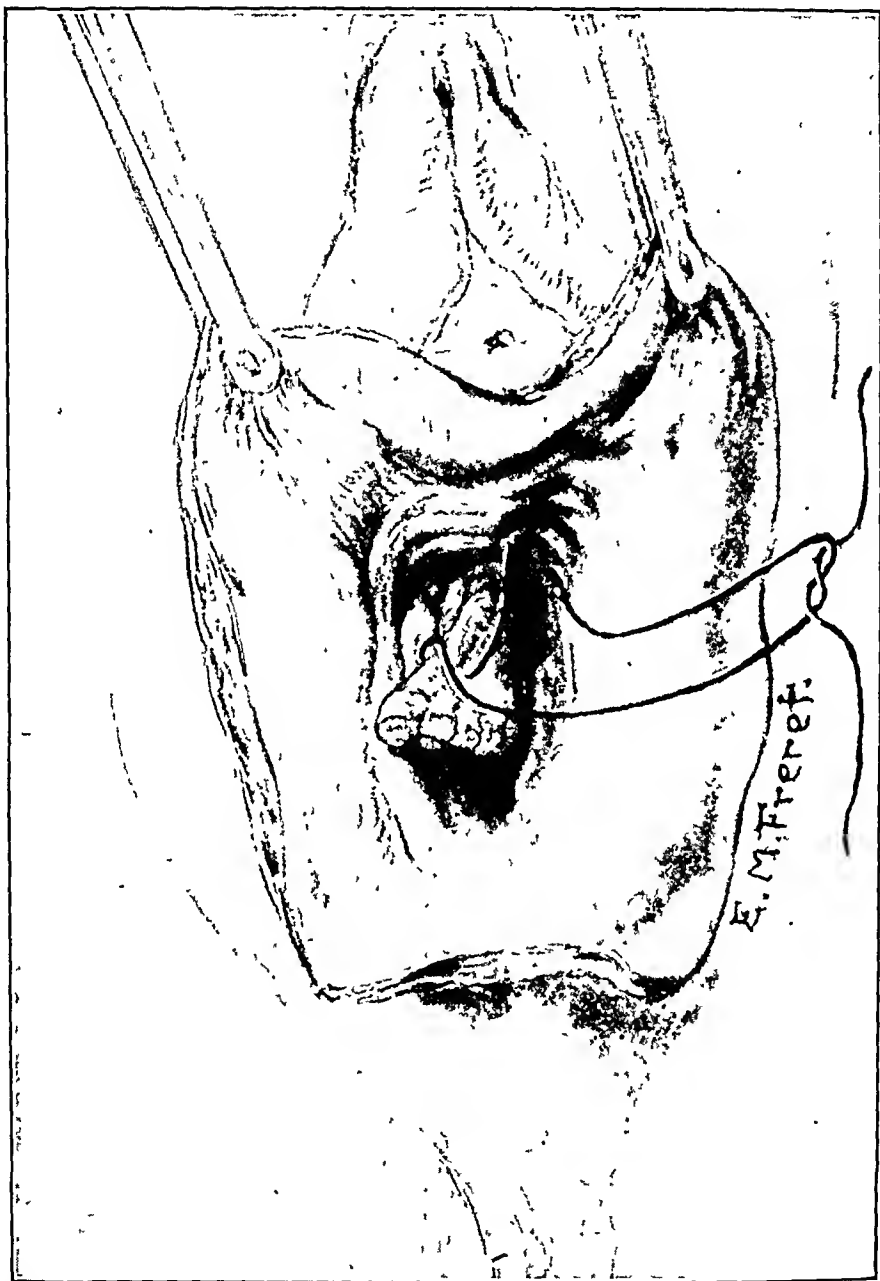


FIG. 272.—SHORT, STOUT, ROUND-POINTED, CURVED NEEDLE, ARMED WITH NO. 2 TANNED OR CHROMIC GUT, IS PASSED INTO PERIOSTEUM OF PUBIC RAMUS ABOUT 2 CENTIMETERS TO ONE SIDE OF MIDLINE OF SYMPHYSIS, THEN THROUGH TOP OF ONE-HALF OF UNITED LIGAMENTS, AND TIED, WITH CARE THAT THE BLADDER WALL BE PUSHED WELL UP AND NOT CAUGHT DURING THE TYING.

anchored in the same manner and a third suture is placed in the midline, catching the tissues on both sides of the urethra and the center of the united ligaments, Figure 273. This third suture we consider most essential to prevent a possible protrusion of the bladder wall over the top of the ligaments. The

vaginal incision is closed with interrupted No. 2 tanned gut sutures, each suture catching up the united ligaments in midline, Figure 274.

The incision at the vault of the vagina is trimmed and sutured to the base of the broad ligaments with a continuous puckering stitch, Figure 275.

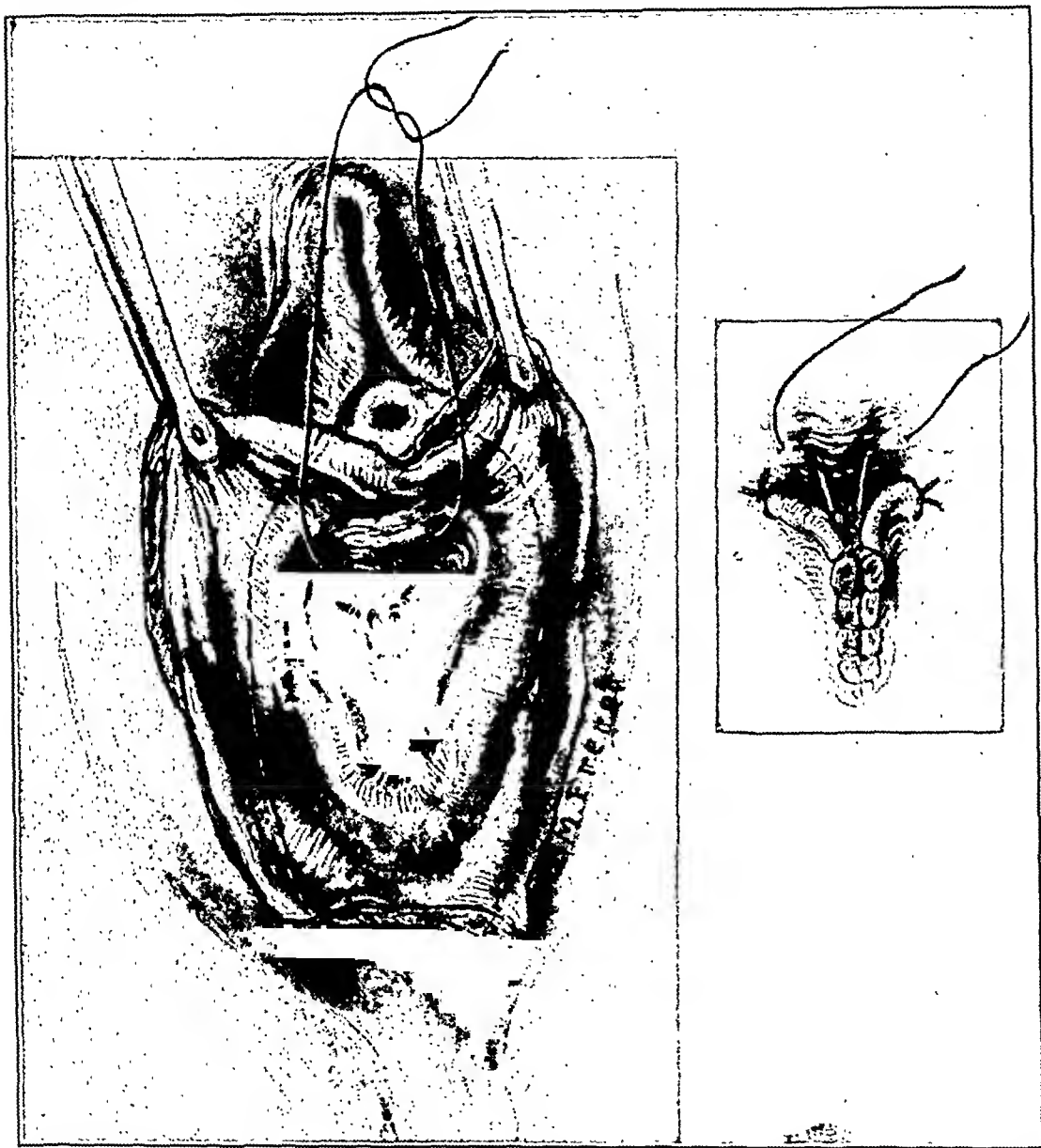


FIG. 273.—RIGHT SIDE ANCHORED AS IN FIGURE 272, AND THIRD SUTURE PLACED IN MIDLINE, CATCHING TISSUES ON BOTH SIDES OF URETHRA AND CENTER OF UNITED LIGAMENTS. Excess margins of vaginal flaps next trimmed away along lines indicated.

The Y drain of rubber tissue described in the Watkins technique is then passed into the line of suturing between the ligaments and the vaginal wall as a precaution against hematoma or infection, to be removed after forty-eight hours, Figure 256.

The operation is completed with a repair of the rectocele and relaxed or lacerated pelvic floor as described in Chapter XX.

C. Farrar Operation for Large Cystocele Associated with Myomatous Uterus.—Occasionally one sees a large cystocele associated with large myomata in the fundus uteri. Frequently there is also a badly diseased cervix, and the problem of finding an adequate support for the bladder after removing the

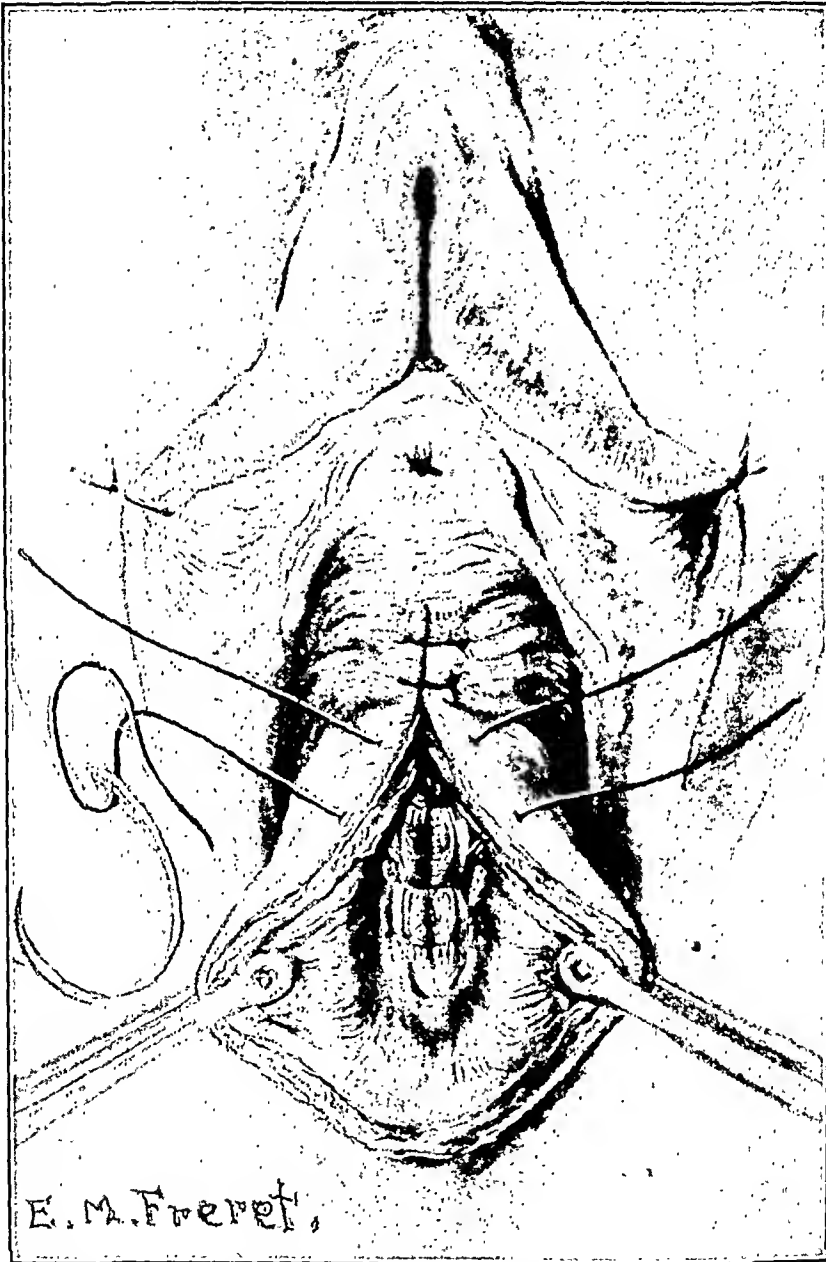


FIG. 274.—VAGINAL INCISION CLOSED WITH INTERRUPTED NO. 2 TANNED GUT SUTURES, EACH SUTURE CATCHING UP UNITED LIGAMENTS AT THEIR MIDLINE.

uterus is difficult, as it is not feasible to remove the uterus from below as in the Mayo technique on account of the large myoma. Lilian Farrar meets this condition as follows:

The cervix is amputated and the anterior vaginal wall opened, the bladder separated from it and from the uterus, and the uteropubic fascial ligaments isolated as in the technique for cystocele in the childbearing woman. The

bladder is left completely loosened from its uterine attachments, the vagina closed, and the pelvic floor repaired as in the before-mentioned technique. The abdomen is then opened and a supravaginal hysterectomy done.

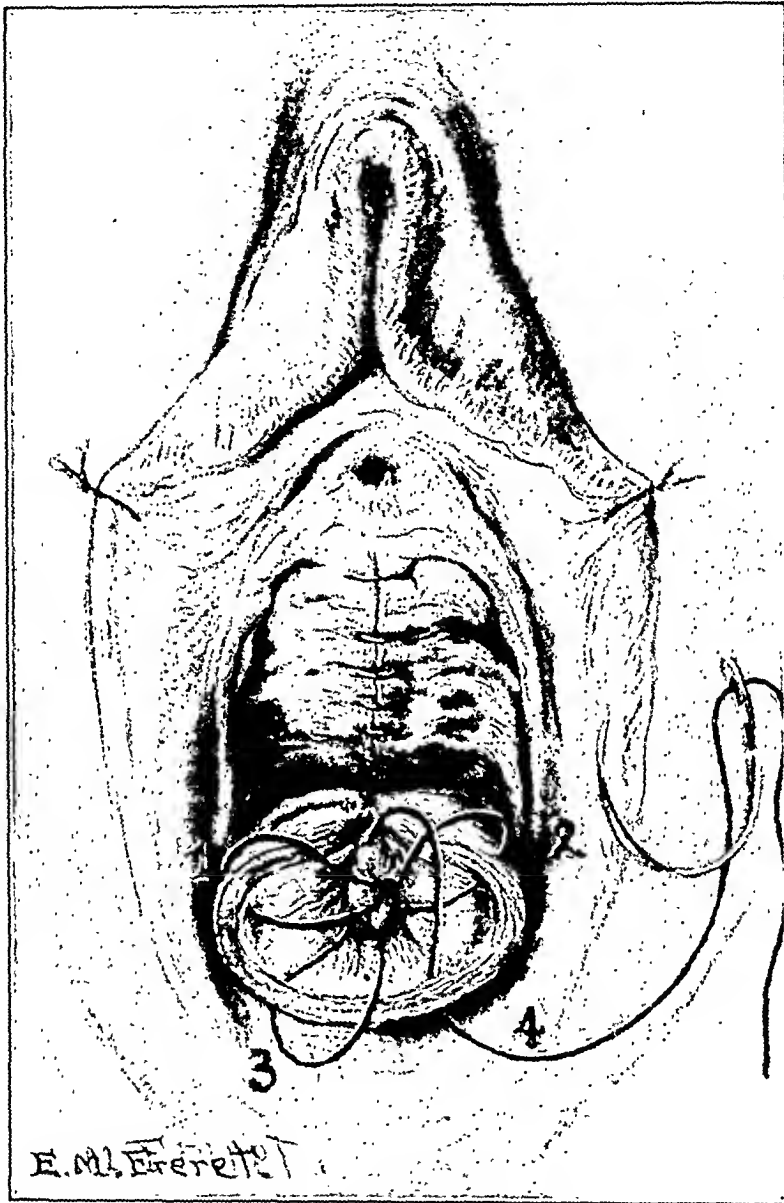


FIG. 275.—INCISION AT VAULT OF VAGINA TRIMMED AND SUTURED TO BASES OF BROAD LIGAMENTS WITH CONTINUOUS PUCKERING STITCH.

A rubber drain is passed into line of suture between broad ligaments and vaginal wall as shown in Figure 256.

The round ligaments (and the tubes and ovaries if not removed) are fastened anteriorly to the stump of the cervix and the uterosacral ligaments plicated posteriorly and attached to the cervix stump to form a platform upon which to spread out the bladder base.

The bladder is then drawn upward to the fullest extent and its base sutured to the anterior and posterior surface of the platform that has been

constructed and the operation completed by suturing the free edge of the bladder peritoneum to the posterior surface as shown in Figures 276 to 279.

This provides a good support for a cystocele when both fundus and cervix must be removed. The firm cervical attachments of the broad ligaments are

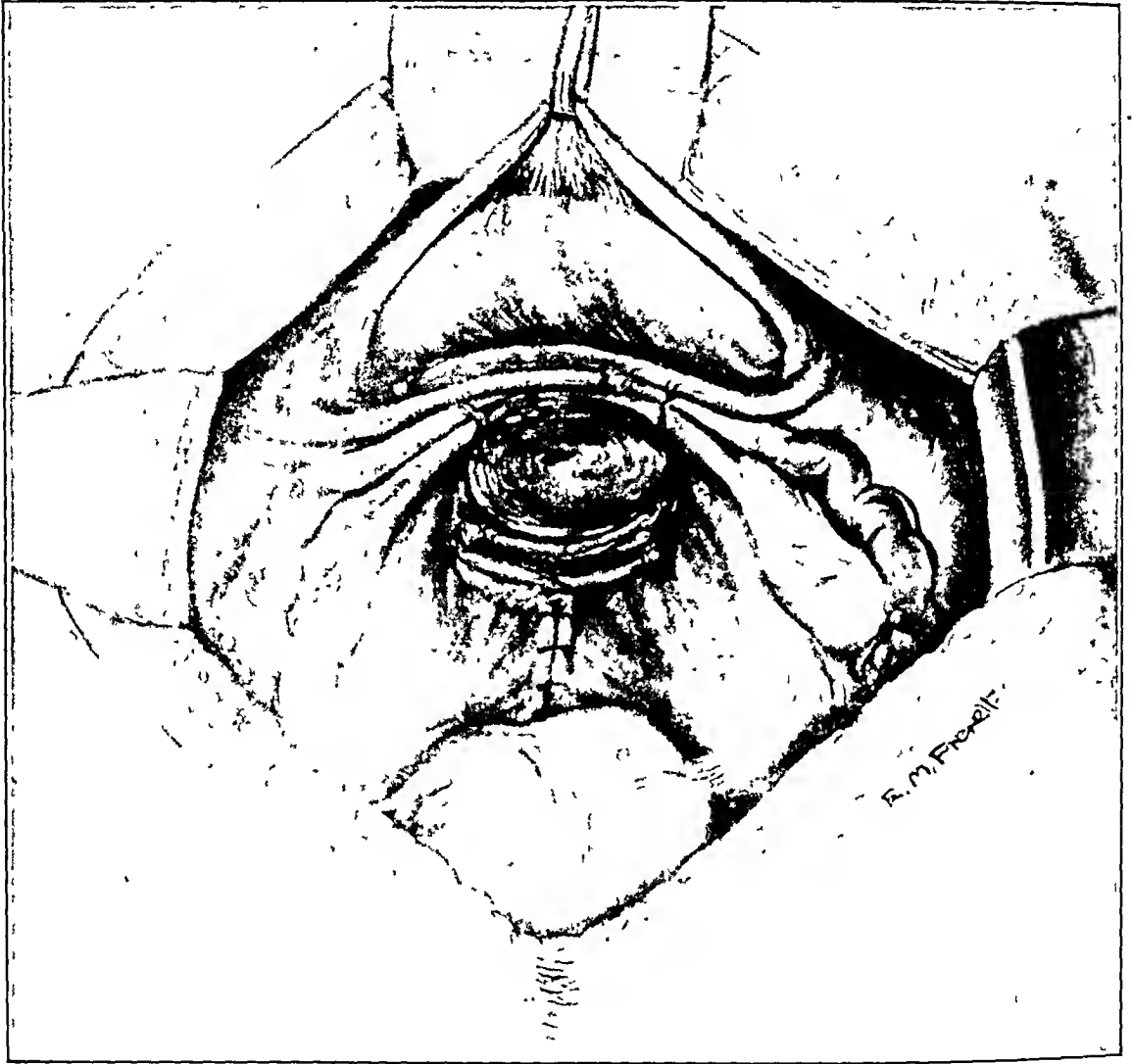


FIG. 276.—ROUND LIGAMENTS (AND TUBES AND OVARIES IF NOT REMOVED) FASTENED ANTERIORLY TO STUMP OF CERVIX; UTEROSACRAL LIGAMENTS PLICATED POSTERIORLY AND ATTACHED TO CERVIX STUMP TO FORM PLATFORM UPON WHICH TO SPREAD OUT BLADDER BASE.

maintained and the bases of the broad ligaments, uterosacral, and round ligaments are all utilized to furnish pelvic support for the bladder. The bladder is spread out over a platform which prevents any considerable degree of infolding of the bladder wall or kinking of the ureters.

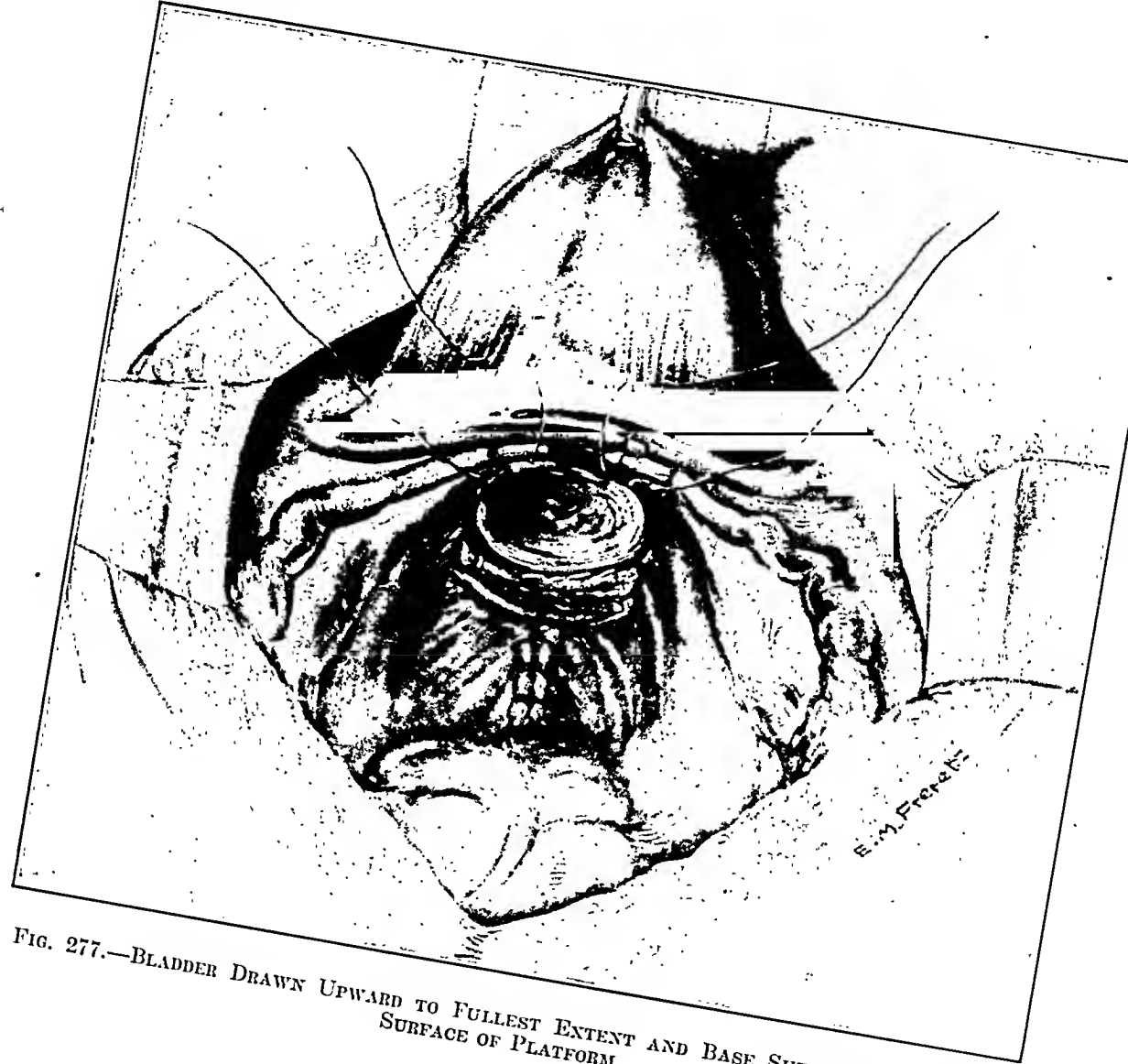


FIG. 277.—BLADDER DRAWN UPWARD TO FULLEST EXTENT AND BASE SUTURED TO ANTERIOR SURFACE OF PLATFORM.

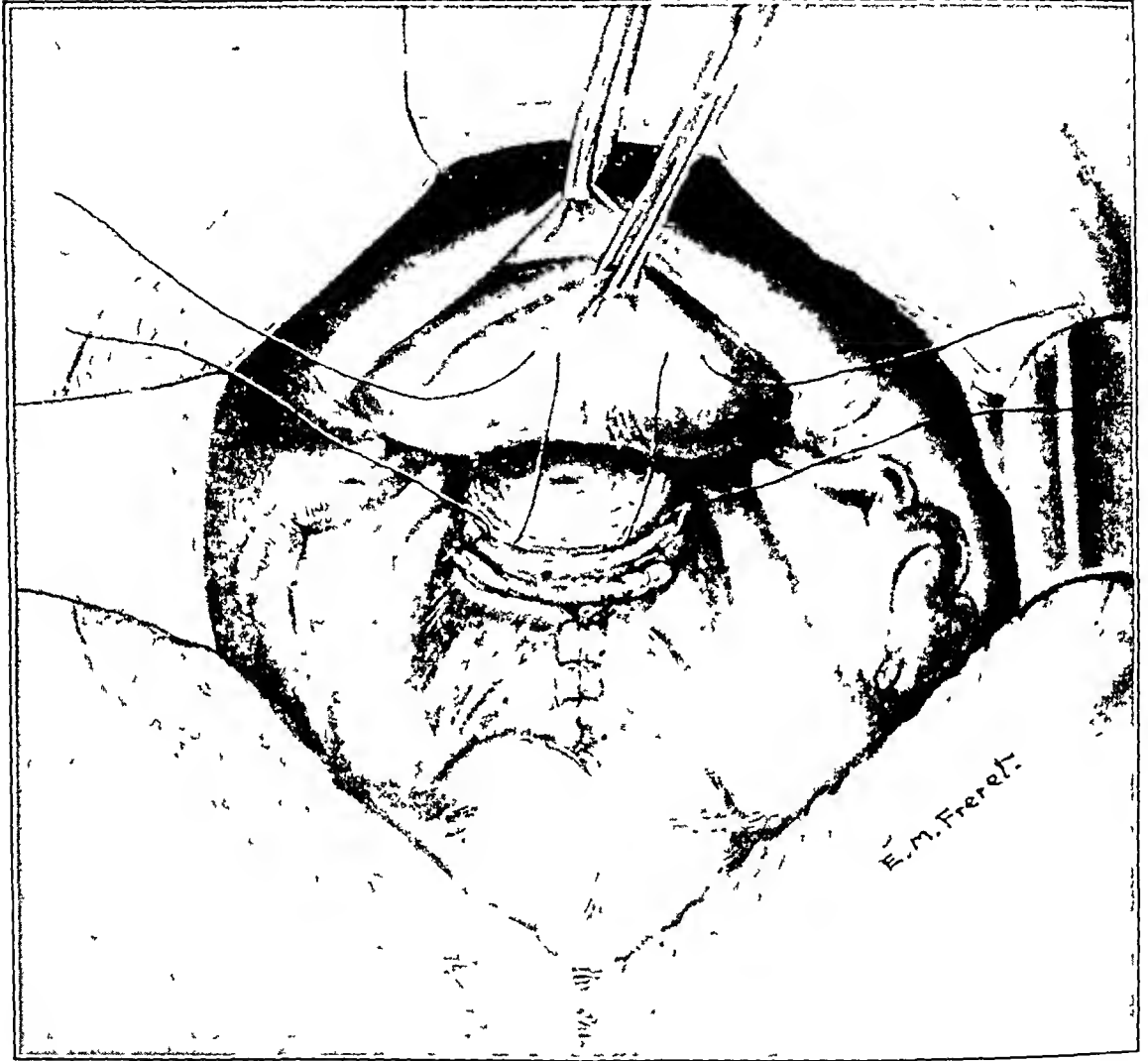
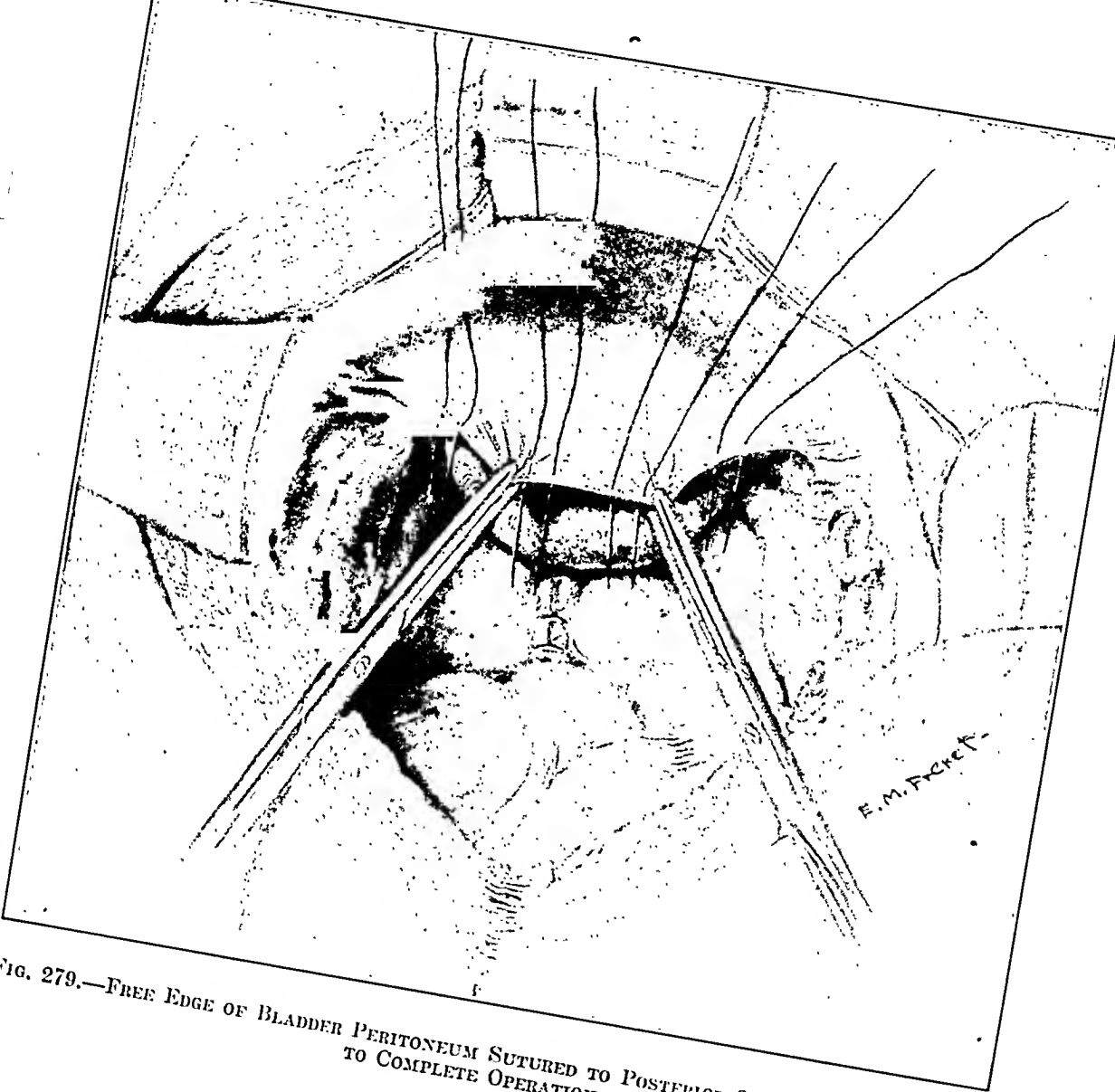


FIG. 278.—BASE OF BLADDER SPREAD OVER STUMP OF CERVIX AND SUIURED TO POSTERIOR SURFACE OF PLATFORM.



E. M. FICKET

FIG. 279.—FREE EDGE OF BLADDER PERITONEUM SUTURED TO POSTERIOR SURFACE OF PLATFORM
TO COMPLETE OPERATION.

CHAPTER XX

RECTOCELE, ENTEROCELE, INJURY TO PELVIC FLOOR

GEORGE GRAY WARD

INJURY TO PELVIC FLOOR

RECTOCELE

Operation

ENTEROCELE

Operation

INJURY TO PELVIC FLOOR

Since Emmet's enlightening paper in 1883, on pelvic floor injuries, the subject is naturally divided into two classes: (1) True lacerations of the perineal body itself, the "median line tears," of importance when the injury involves the function of the sphincter ani; (2) injury to the pelvic fascia and levator ani muscle, the so-called "sulcus tears," crippling one of the important functions of the posterior segment of the pelvic floor; namely, the ability properly to close the vaginal orifice.

In the first group, the nature of the injury is most apparent and the principle of its cure obvious. The sphincter ani muscle may be likened to the letter O. The median line tear becomes important according as it invades the integrity of this muscle; when torn through it immediately becomes converted into a U, as the torn ends of the muscle spring apart. The principle of cure is obviously the reunion of the separated ends reconverting the U into the original O. The technique of this operation is given elsewhere.

In the second group, the conditions are more complicated and obscure and in consequence there have been innumerable discussions as to the best methods of relief. A proper understanding of the mechanism of the closure of the vaginal orifice is necessary to an appreciation of the impaired function. A usual idea is that the closure of the orifice is sphincteric similar to that of the anus, while in fact the actual mechanism of opening and closing the vaginal introitus is quite different. It has been our custom in teaching to compare the mouth and the vaginal orifice.

In the mouth, we have a transverse slit with a fixed upper jaw and a movable lower jaw, the mouth being closed by raising the lower jaw against the upper by the masseter muscles. If these muscles are cut, torn, or stretched, there results an inability to close the mouth, and the lower jaw hangs down.

In the vaginal orifice, we have a transverse slit, with a fixed anterior and a

movable posterior vaginal wall constituting the pelvic floor. The orifice is closed by raising the mobile posterior against the immobile anterior segment by the levator muscle, as in the mouth, and not by a sphincteric action, in spite of the so-called sphincter vaginæ muscle.

Ramifications of the pelvic fascia give support and strength to the levator in the vaginal sulci, where it is ruptured by the advancing fetal head, when it receives the brunt of the strain during the internal rotation in labor, or is torn, frequently in both sulci, by the forceps blades. A condition then produced is similar to a rupture of the fascia lata of the thigh when the strain in standing falls upon the quadriceps extensor, with resulting tire and ultimate stretching of that muscle. The torn pelvic fascia allows the strain to fall upon the anterior fibers of the levator torn away from its lateral attachments to the rectum and the perineal body, into which the fibers of each muscle decussates with its fellow. The consequence is ultimate stretching and relaxation, while the result is that the posterior segment of the pelvic floor is not properly lifted because of the elongated or torn levator fibers. The vaginal mouth, therefore, is constantly gaping, and the unsupported vaginal walls with their attached viscera tend to roll down and out. The strength and support of the posterior vaginal wall and rectum reside in the firm barrier formed by the fusion of the two layers of the levator fascia, the fascia of the urogenital diaphragm and Colles's fascia at the site of the perineum. Should this fascial support of the posterior vaginal wall and rectum be injured, the open vaginal mouth then favors the protrusion or hernia of the anterior rectal wall at the site of the injury, designated a rectocele. Such an anatomic change alters the normal mechanism of defecation by diverting the direction of the fecal current so that the anterior rectal and the posterior vaginal wall receive the brunt of the strain with a consequent protrusion which increases until a distinct rectal pouch forms and renders complete evacuation difficult.

The chapter on the anatomy of the pelvic floor by L. K. P. Farrar elucidates the principles involved and the technique advocated in repairing these injuries.

RECTOCELE

Conditions in a rectocele are similar to cystocele considered in Chapter XIX. Both are due to an injury of the fascial supports and their development is accelerated by the patent vaginal orifice following the pelvic floor injury.

In the past the operation advocated to cure cystocele and rectocele was the shutting of the vaginal mouth by an operation based on the Emmet principle, taking up the slack or excess of vaginal tissue by a superficial denudation of the mucosa and the approximation of the edges. This apparently produced a good immediate result, but the prolapsed bladder and rectum were simply thrown into folds, which the daily exercise of their functions soon obliterated, and the results were evanescent.

In recent years, the cystocele problem has been well worked out. B. E. Hadra first and then M. Sanger urged a more radical procedure to insure permanency and showed that the bladder must be completely separated from the vaginal wall, as well as the uterus, and shifted to a higher plane in the pelvis and that the fascial opening must be repaired, and finally the excess of the vaginal wall resected. J. R. Goffe's operation is a typical example of the modern radical method which, contrasted with the older procedure, is like comparing the Halsted-Bassini operation with an attempt to cure inguinal hernia by simply suturing the pillars of the external ring.

In rectocele we have a true hernia or prolapsus of the rectum perfectly analogous to cystocele. The bowel also becomes enlarged and pouched until there is an increase in the size of the gut, similar to that of the bladder in cystocele.

Not infrequently the antiquated therapeutic measures still employed for the cure of this hernia consist either in the denudation and approximation of the divided edges of the posterior vaginal tissue, or in a resection of the excess vaginal wall with a turning in and plication of the bowel. These plications are in the end smoothed out by the daily passage of the feces, especially in constipation. In all this group of operations perineorrhaphy is relied upon to close the vaginal orifice, and prevent descensus of the vaginal walls.

It is obvious that as a rectocele parallels cystocele, we ought to apply the identical principle which has proved so successful in vesical prolapse, and this we have done with uniform success for many years.

The operation consists in the complete separation of rectum and posterior vaginal wall, as far up as the culdesac of Douglas, sliding the loosened rectal pouch high up along the vaginal wall, fastening it there with a suture, and closing the fascial opening. By this the denuded rectum is drawn up and secured and made to adhere to the upper undamaged posterior vaginal wall well above the site of the former rectocele.

A perineorrhaphy follows in the form of a muscle operation. By approximating the anterior levator fibers, the muscle barrier thus formed acts also as a dam to prevent the recurrence of the rectocele, in addition to furnishing an effective restoration of the vaginal orifice. The perineorrhaphy described has been done in its essentials by G. G. Ward since May, 1908, with slight modifications (*Surg., Gynec., & Obst.*, Sept., 1913, 361).

The advantages of dissecting out the anterior edges of the levators and uniting them in the median line, thus reefing the overstretched and elongated fibers so as to lift up the posterior segment of the pelvic floor, have been ably advocated by Holden, Babcock, Haynes, Sturmdorf, and others in recent years.

When we recall the normal decussation of the anterior fibers of both levators in the perineum any objection to this type of operation as anatomically incorrect, is not valid.



E. M. FRERET.

FIG. 280.—SPONGE IN RECTUM OUTLINES RECTOCELE.

Friedman retractor opens introitus widely exposing vaginal sulci. Triangular area of vaginal wall which is to be removed is outlined with a scalpel.

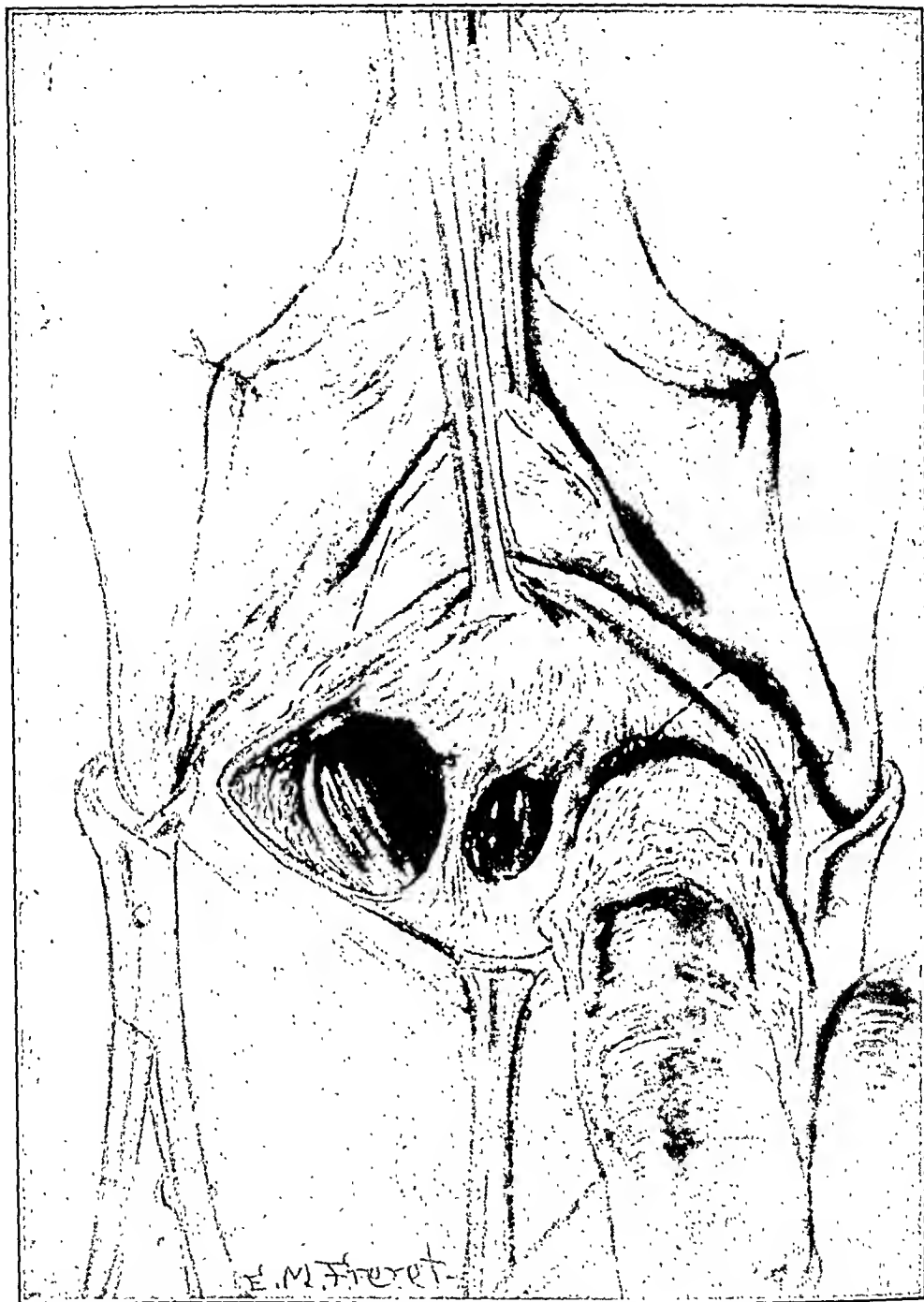


FIG. 281.—SUPERFICIAL AND FUSED FASCIAL STRUCTURES CUT THROUGH AND LEVATOR MUSCLE AND RECTUM SEPARATED IN EACH SULCUS BY BLUNT DISSECTION WITH GAUZE-COVERED FINGER.

Anterior fibers of levator freely exposed.

Operation.—The labia minora are drawn out of the way, and sutured to the skin. A gauze sponge on a sponge holder is inserted in the rectum as a guide. The introitus is opened wide with a Friedman retractor which catches each posterior caruncle just below the orifices of Bartholin's glands, taking care not to occlude them. A third forceps is attached to the posterior vaginal wall in the median line, marking the crest of the rectocele. Making

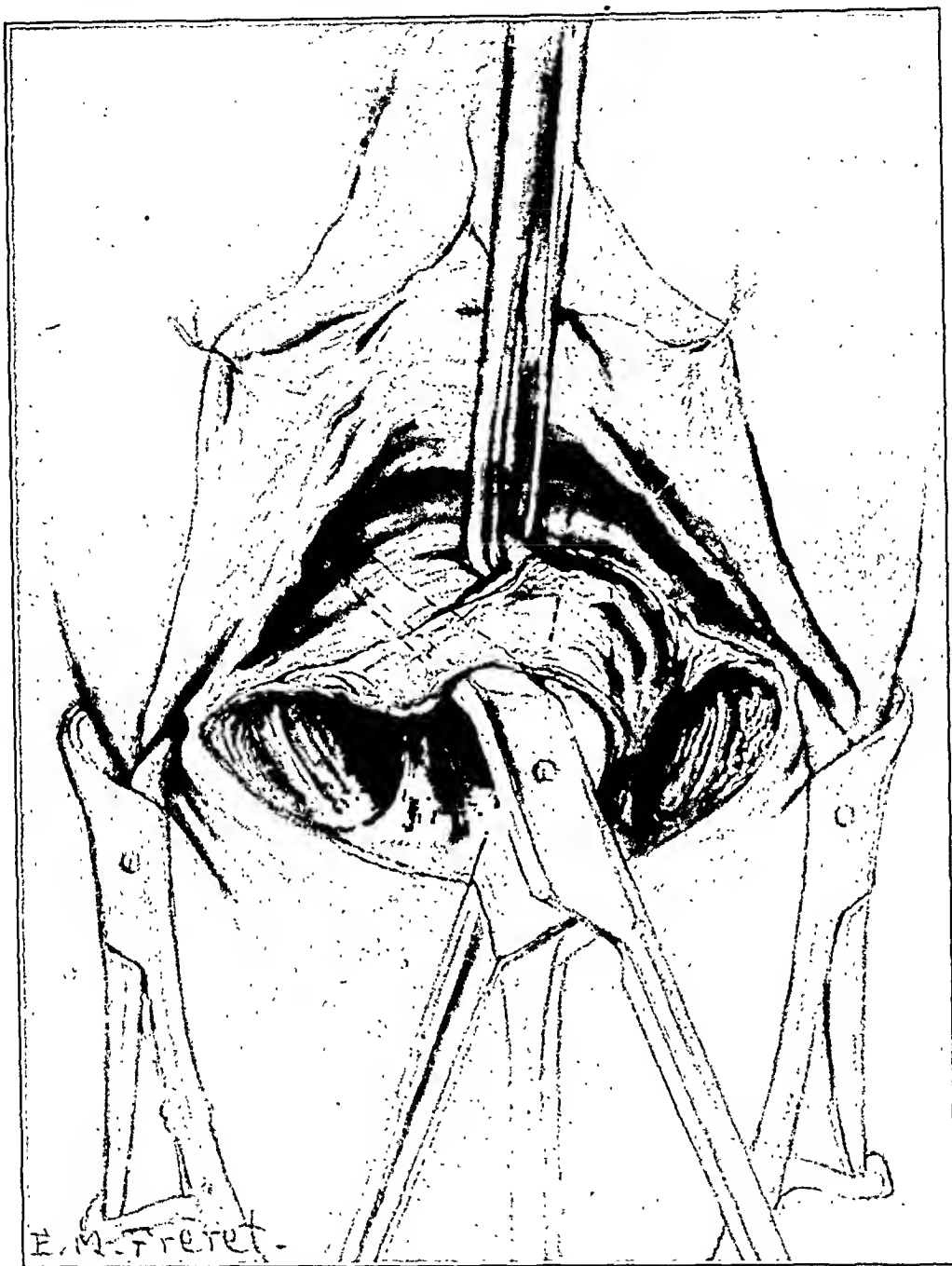


FIG. 282.—RECTUM SEPARATED FROM VAGINAL WALL WELL ABOVE AREA OUTLINED FOR REMOVAL.

Blunt-pointed angular scissors inserted in line of cleavage while closed, then opened widely and withdrawn while open. Sponge forceps in rectum is a guide to the path of safety.

traction on these tenacula, the resulting triangle is outlined with a scalpel. This area represents the excess vaginal wall to be removed subsequently; marking its boundaries at the outset greatly facilitates its accurate removal as a later step, Figure 280. :

With blunt scissors, the base of the triangle is dissected free from side to

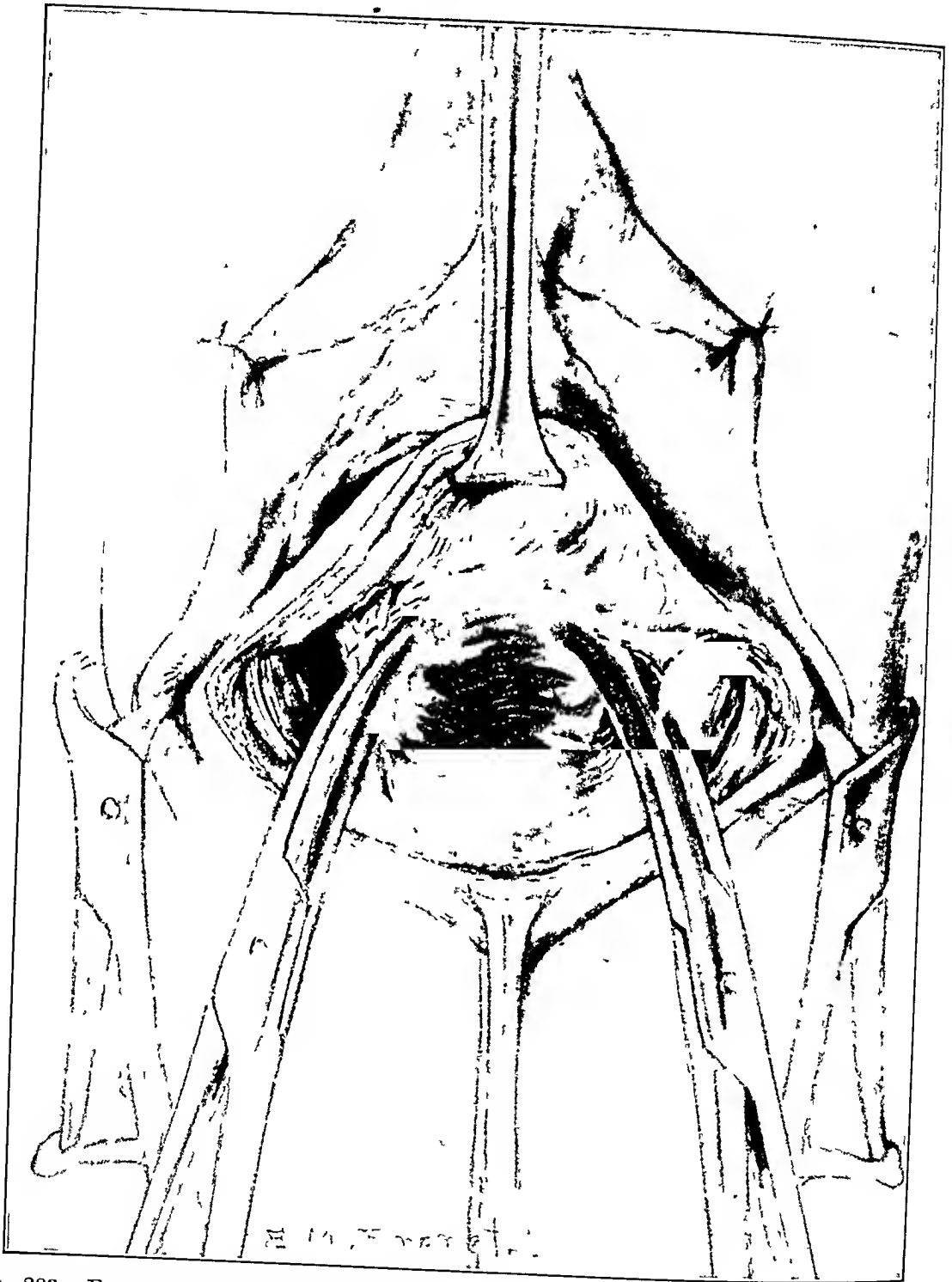


FIG. 283.—FASCIAL STRUCTURES SEPARATING RECTUM FROM LEVATORS CLAMPED CLOSE TO VAGINAL WALL AND UPWARD FOR 1.5 CENTIMETERS, AND CUT AWAY AT SITE OF DOTTED LINES.

side, and the superficial and fused fascial structures cut through. By blunt dissection the gauze-covered finger opens up the line of cleavage between the side of the rectum and the levator muscle in each sulcus, the finger penetrating deeply between the muscle and its superior layer of fascia which is also attached to the rectum and the under surface of the vaginal sulcus. This dissection

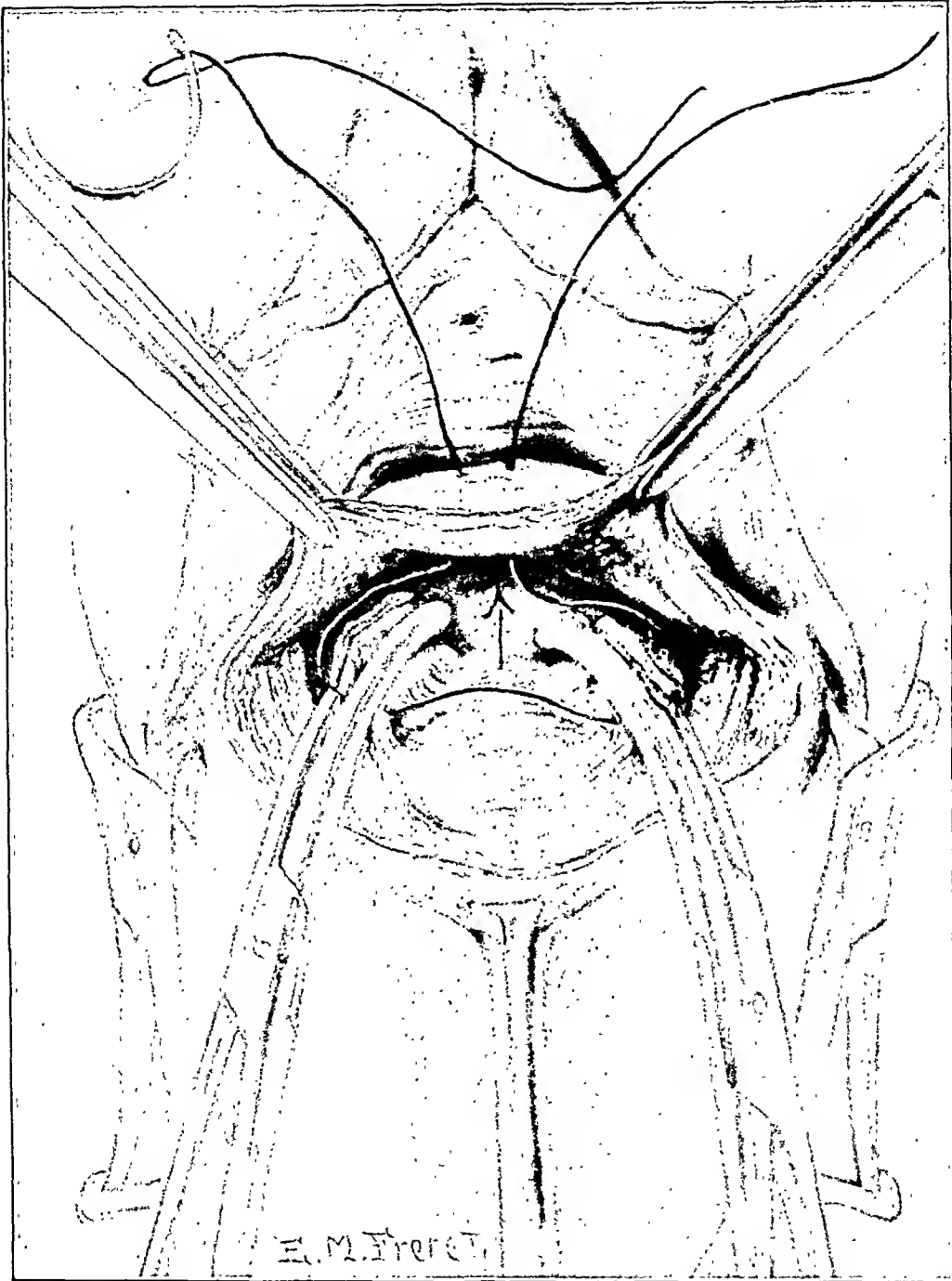


FIG. 284.—RECTOPENY.

A suture is passed through vaginal wall in midline well above position of rectocele and is brought down between vagina and rectum and passed through lower margins of fascial stumps and returned through vaginal wall close to point of origin. Clamps removed and suture tightened and tied. Mobile rectal pouch thus drawn upward and fastened to undamaged vaginal wall above site of rectocele.

ought freely to expose the anterior fibers of the levator as well as its superior surface, Figure 281.

The rectum is next separated from the posterior vaginal wall well above

the area of the vagina outlined for removal, by inserting and pushing closed blunt-pointed scissors up the line of cleavage, and opening them wide and withdrawing them open. The sponge and forceps in the rectum furnish a

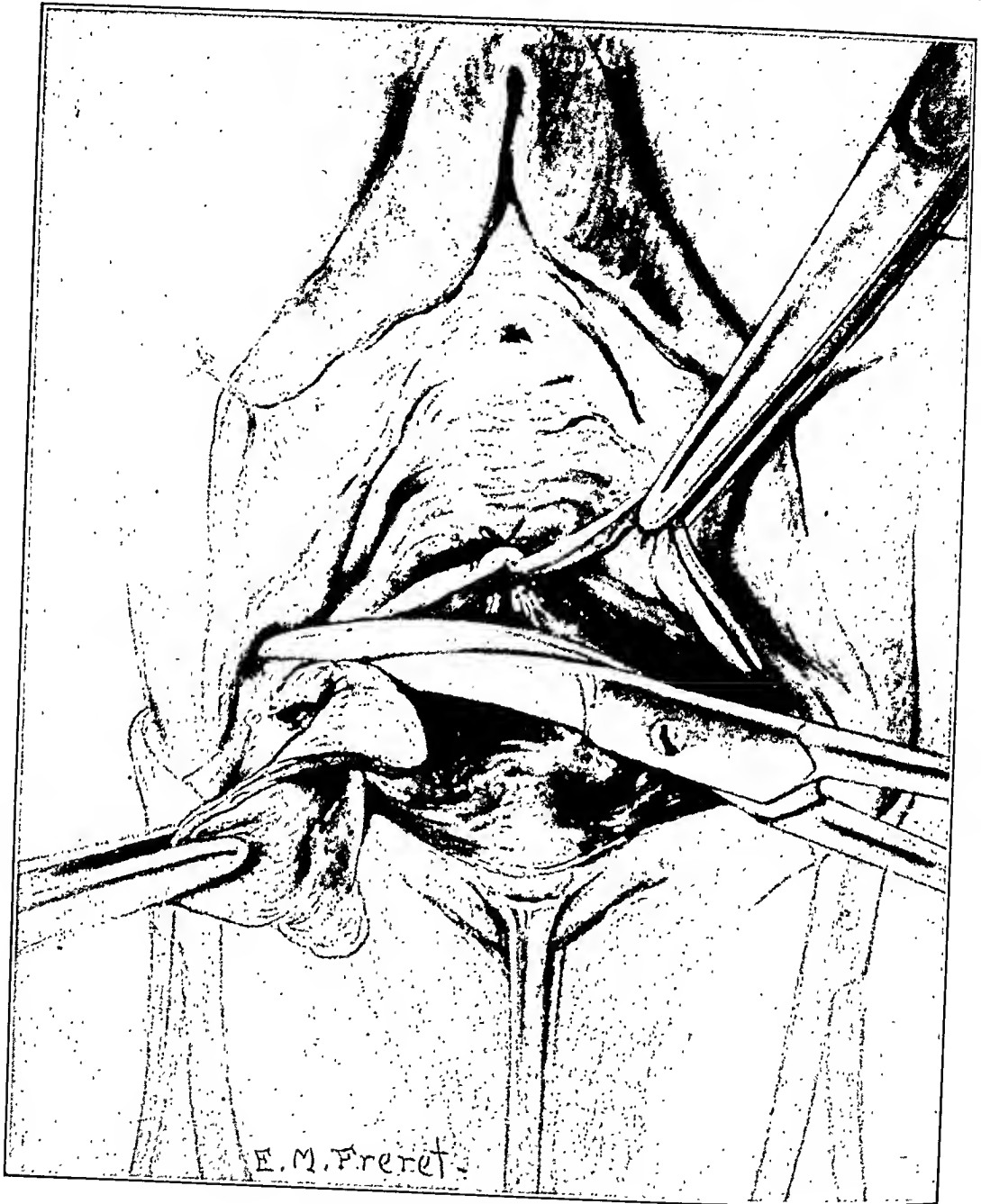


FIG. 285.—RECTOPEXY.

Rectopexy stitch tied and dilated vaginal wall cut away along incision outlined at beginning of operation.

guide as to the path of safety. A wide space is thus opened up between the rectum and vagina well above the site of the rectocele, Figure 282.

The levators are now freely exposed and the rectum separated from the vagina; the layer of pelvic fascia, covering the superior surfaces of the levators (rectovesical fascia) and attached to the sides of the rectum and to the under

surface of the vaginal sulci, upon separation from the muscle forms partitions, which divide the dissected area into three spaces. Curved clamps are placed on these fascial partitions close under the vaginal wall, extending upward

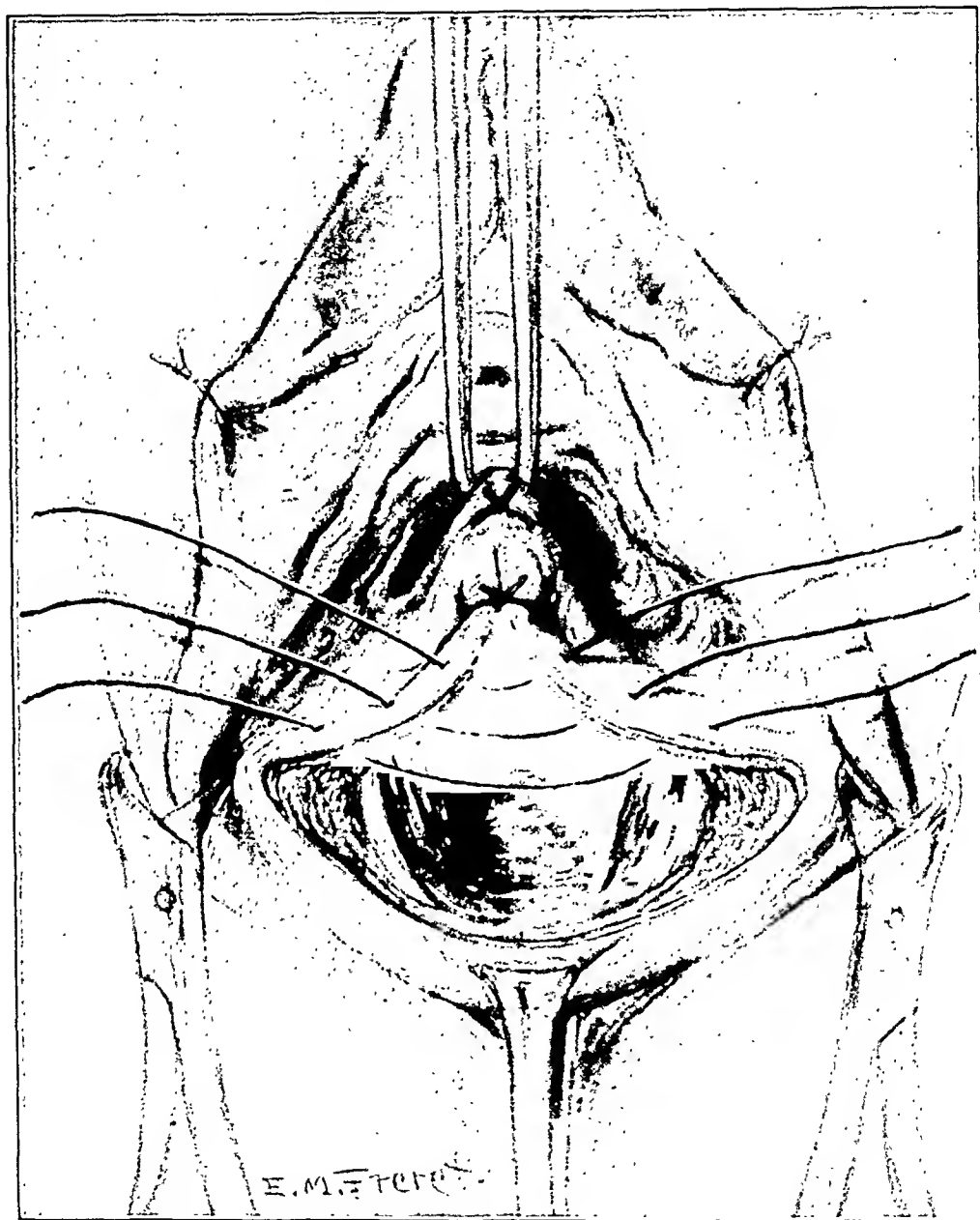


FIG. 286.—CUT EDGES OF VAGINA SUTURED, CARE BEING TAKEN TO INCLUDE THE TWO FASCIAL STUMPS IN THE UPPER SUTURES TO INSURE CLOSURE OF SPACE BETWEEN THEM.

about 1.5 centimeters, and the fascia severed from its vaginal attachments, Figure 283.

A No. 2 tanned catgut suture is passed through the vaginal wall in the midline, well above the site of the rectocele, is brought down between vagina and rectum and passed through the lower margins of the fascial stumps grasped

by the clamps, and returns to pass back through the vaginal wall near the first point of entrance.

When this suture is tightened and tied it obviously draws the mobile rectum

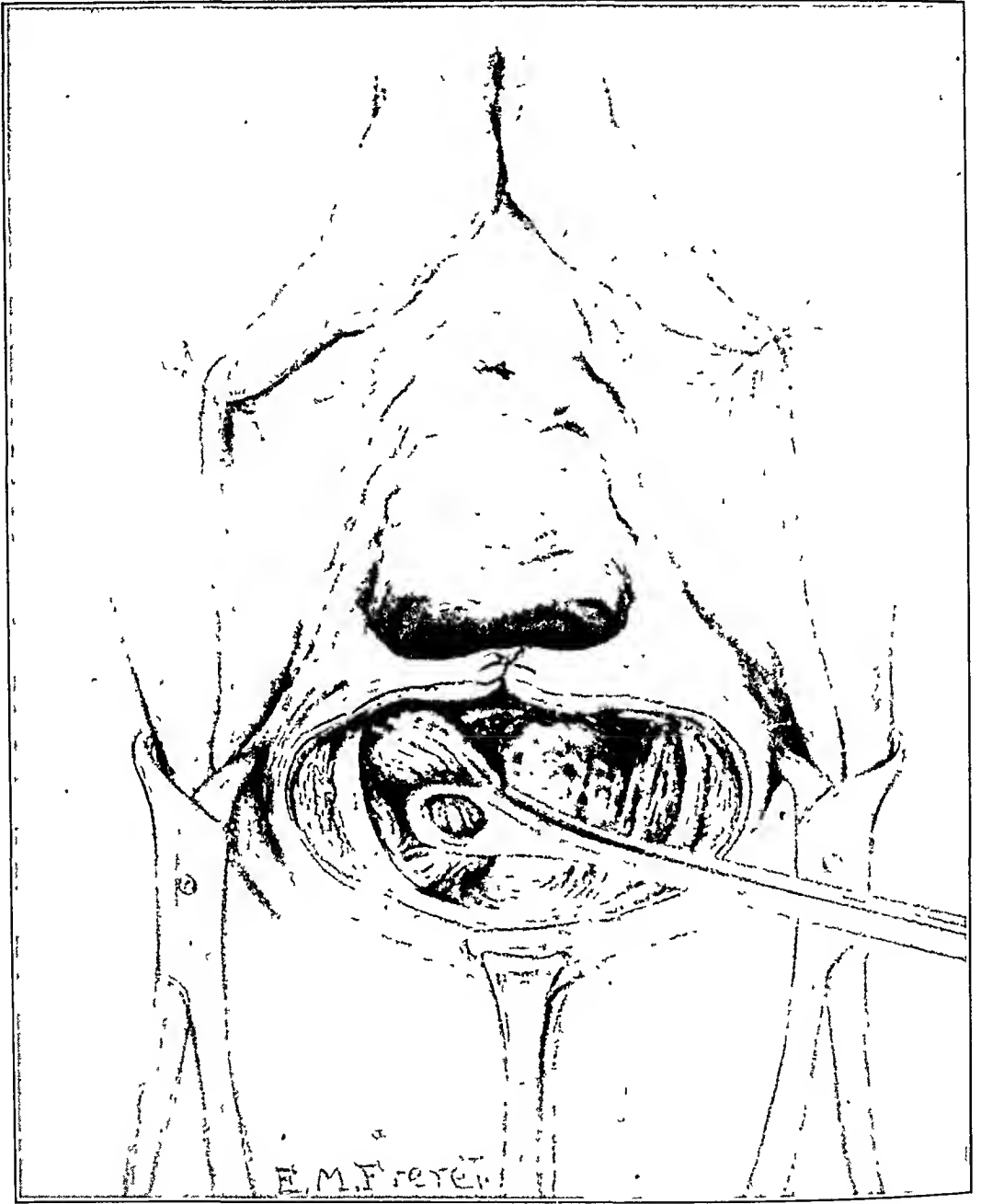
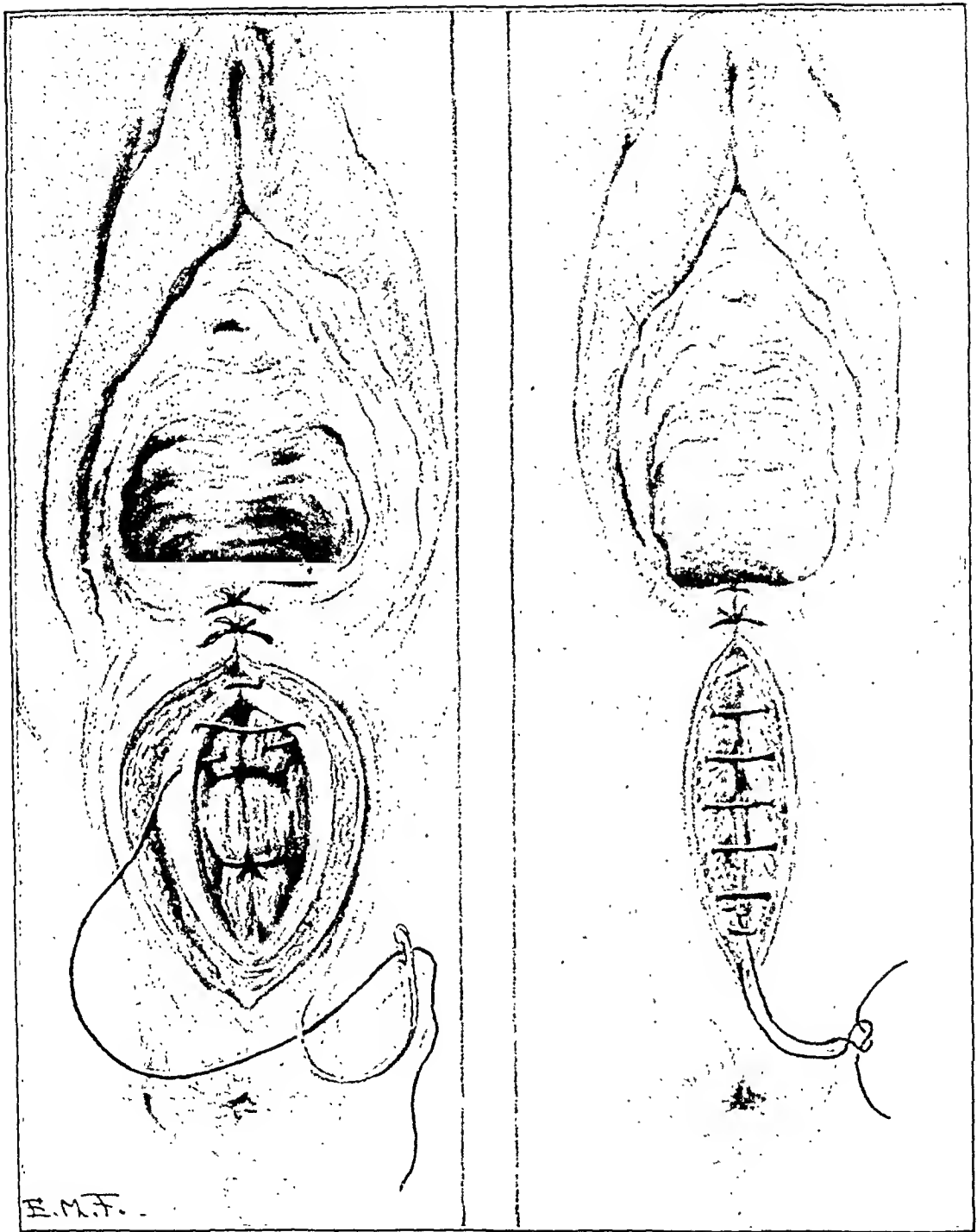


FIG. 287.—ANTERIOR MARGINS OF LEVATORS GRASPED WITH SPONGE FORCEPS AND DRAWN TOWARD MIDLINE.

upward well beyond the limit of the subsequent resection of the vagina. Thus the denuded rectum is carried up and placed where it will adhere firmly to the upper undamaged third of the posterior vagina above the former site of the rectocele. We designate this procedure as "rectopexy," Figure 284.

The dilated part of the vaginal wall which entered into the formation of



A

B

FIG. 288.—A, LEVATORS SUTURED TOGETHER WITH INTERRUPTED CATGUT SUTURES. SHARP EDGE OF COLLES'S FASCIA SEEN ON EACH SIDE OF WOUND NEXT SUTURED WITH CONTINUOUS SUTURE, WHICH AT ITS ORIGIN IS PASSED WIDE AND DEEP TO INCLUDE FUSED FASCIAL STRUCTURES AT THIS POINT. SUTURE ALSO CATCHES UNITED LEVATORS.

B, SKIN MARGIN THEN CLOSED WITH A SUBCUTICULAR TANNED CATGUT SUTURE AND END TIED TO FASCIAL STITCH. THE KNOT DISAPPEARS BETWEEN MARGINS OF THE INCISION.

the rectocele is then cut away along the lines of the incision outlined at the beginning of the operation, Figure 285, and the cut edges of the vagina sutured with interrupted tanned catgut sutures, taking care to include the two fascial stumps in the upper sutures so as to insure the closure of the space between them, Figure 286.



FIG. 289.—ENTEROCELE AND RECTOCELE.

Dotted lines indicate normal limits of culdesac of Douglas and rectum.

The anterior margins of the levators are then grasped with sponge forceps, drawn toward the midline, Figure 287, and sutured together with interrupted catgut sutures, Figure 288-A. The effect of this approximation of the levators is immediately apparent, the shortening of the muscles lifting up the relaxed pelvic floor and forming a strong barrier to further descent of the rectum.

The sharp edge of Colles's fascia on each side of the wound close to the united levators is sutured with a continuous No. 1 tanned catgut suture. At

its origin this suture is passed wide and deep to unite the fused fascial structures of the urogenital diaphragm, levator fascias, and Colles's fascia; it also catches up the united levator muscles and is half hitched at its termination and left long to tie to the subcuticular suture, Figure 288-A.

The skin margin is then closed with a subcuticular suture of No. 1 tanned

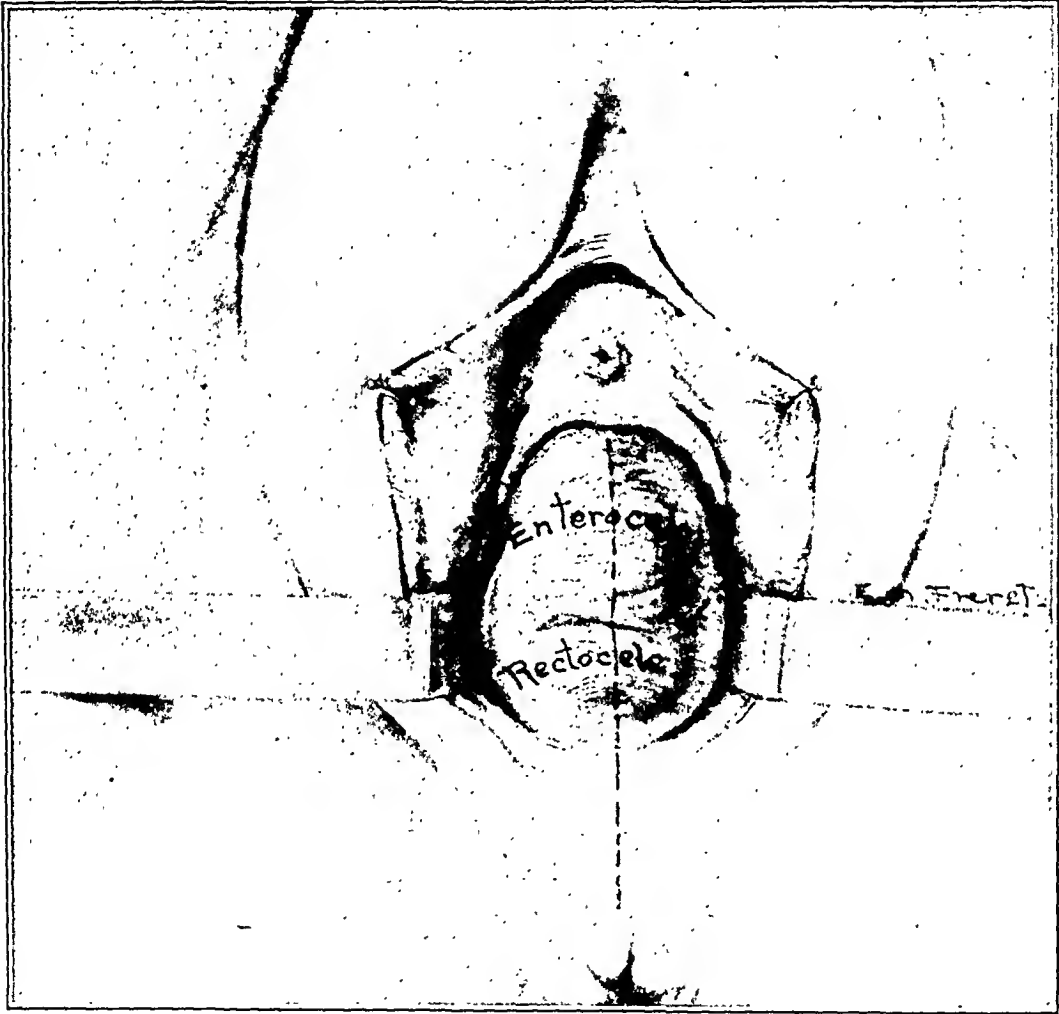


FIG. 290.—ENTEROCELE.

Line of incision.

catgut on a fine needle and the end tied to the fascial stitch, Figure 288-B; the knot disappears between the edges of the incision.

ENTEROCELE

Occasionally another type of hernia, an "enterocele," occurs, involving the posterior vaginal wall; its development is also favored by the impaired function of the pelvic floor. This is often confused with rectocele, but it is an entirely different lesion, although they are usually concurrent.

Posterior vaginal hernia, or "enterocele," has been considered so rare that textbooks either ignore it or only call attention to its infrequency. Also very few cases are recorded in the literature.

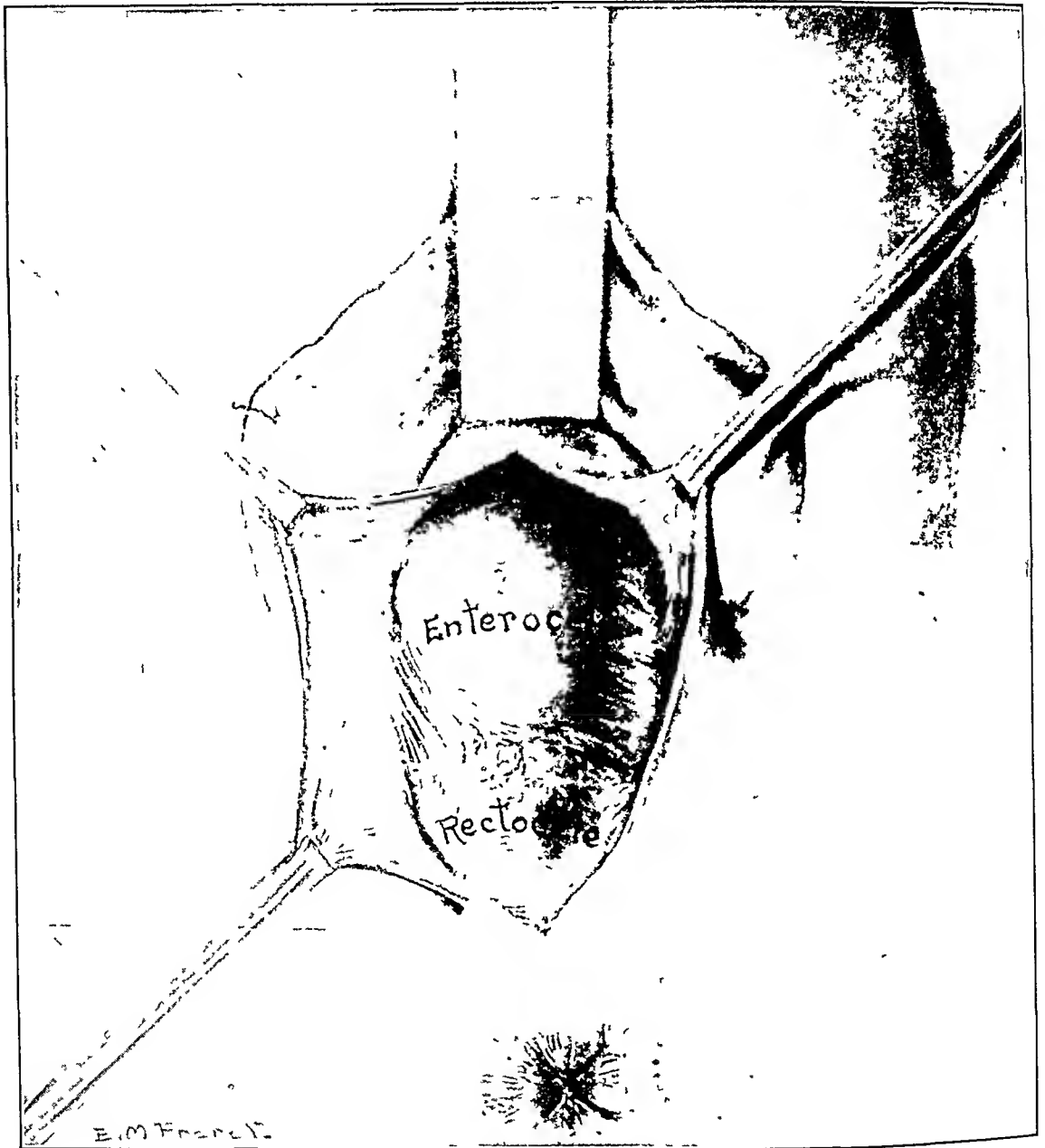


FIG. 291—ENTEROCELE.

Enterocoele exposed and its relation to the rectocele.

Sir Astley Cooper, in his classic work on hernia, however, in 1804, furnishes an illustration of an undoubted instance. Fordyce Barker and T. Gaillard Thomas have reported others, and, in 1916, Hartmann of Paris (*Ann. de Gynec. et d'Obst.*, 1916, 12: 351), published a typical case, with the technique employed for its cure from below. Sweetser (*Ann. Surg.*, 1919, 69: 609) reported one in 1919, illustrative of the extreme type in a nullipara.

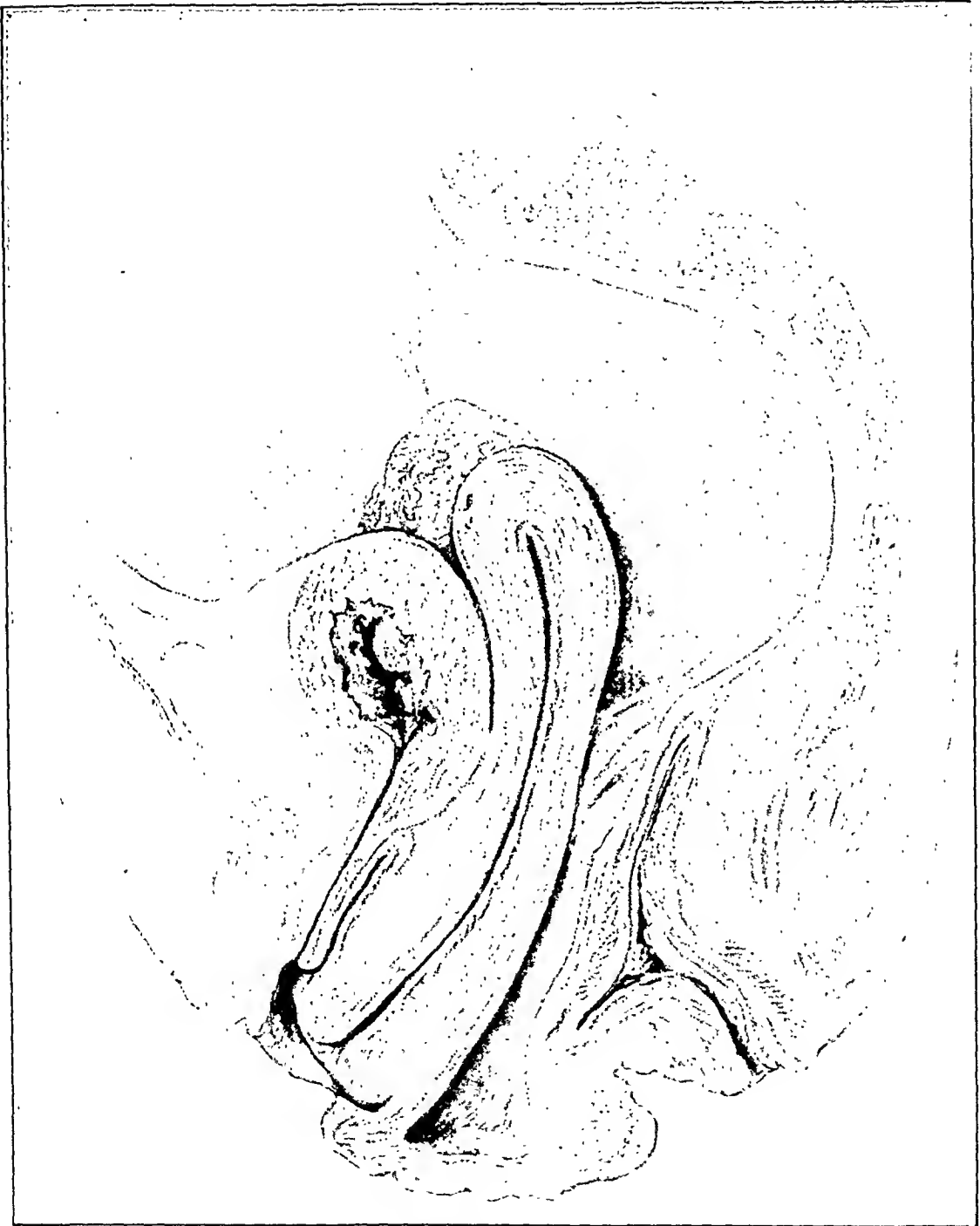


FIG. 292.—ENTEROCELE.

Frozen section from Halban and Tandler demonstrating relation of a deep culdesac of Douglas to prolapsus. Pouch filled with intestines exerts traction on cervix.

The rarity of the condition is undoubtedly due to the obliquity of the pelvic cavity in the erect posture, when the intra-abdominal pressure is deflected forward, as well as to the strong pelvic and rectovesical fascias intimately interwoven with the walls of the canals passing through the pelvic

floor. Moschowitz (*Surg., Gynec., & Obst.*, July, 1912) notes that this fascia has a funnel-shaped attachment to the rectum where a defect allows the intestine to push through along the rectal wall and down to the levators, displacing the peritoneal lining of the culdesac ahead of it. Such a congenital defect in the fascial attachments accounts for the condition in a virgin. Pregnancy and labor causing stretching or separation of the fibers of the fascia account for the acquired form.

Our interest in this subject has been quickened in recent years by the imperfect results in several prolapse patients on whom we used the Mayo technique of vaginal hysterectomy and the interposition of the united broad ligaments below the bladder. While the cure of the prolapsed bladder and anterior vaginal wall was perfect, a well-marked enterocele protruded at the vulvar orifice necessitating a second operation. A careful study of the culdesac in uterine prolapse has convinced us that an enterocele, either beginning or well-developed, is present in a far larger proportion than we have realized, and that it is necessary to recognize and meet this condition with an appropriate technique at the time of the operation for prolapse of the uterus, in order to prevent a definite percentage of imperfect results. We are also convinced that enterocele (of the lesser type) without uterine prolapse is commoner than we formerly thought, and that it is frequently overlooked and classed as a rectocele, while both conditions are often present. The differential diagnosis with the finger in the rectum easily made is not often resorted to.

In recent years at the Woman's Hospital, we have operated on fourteen with abnormally deep culdesacs, with and without associated uterine prolapse. Of these three required a second operation because of our failure to investigate the depth of the culdesac at the time of the original operation. Zuckerkandl, Freund, and others have shown that the culdesac of Douglas normally extends to the levators in the fetus and that its depth gradually decreases until puberty, when it abuts on the level of the second and third sacral vertebrae. Daniel Jones (*Boston M. & S. J.*, 1916, 175: 623) of Boston, who notes that a deep culdesac is an important factor in favoring or in producing uterine prolapse, states that a downward pressure in the culdesac against the posterior vaginal wall elicits a strong pull on the uterus and advocates the closure of the culdesac on this account. He accounts in this way for uterine prolapse in virgins, as such patients always have a deep posterior culdesac of the congenital type.

The value of the technique of Moschowitz for the cure of prolapse of the rectum lies in the fact that the closure of the Douglas pouch throws the weight of the intestines forward on to the bladder, symphysis, and anterior abdominal wall, while the patient is in the erect posture; a deep culdesac, on the other hand, allows the weight of the intestines and the pressure to fall on the anterior rectal and posterior vaginal walls.

Operation.—In view of our experience and in the light of the foregoing statements, it is now our custom to obliterate the pouch of Douglas by the

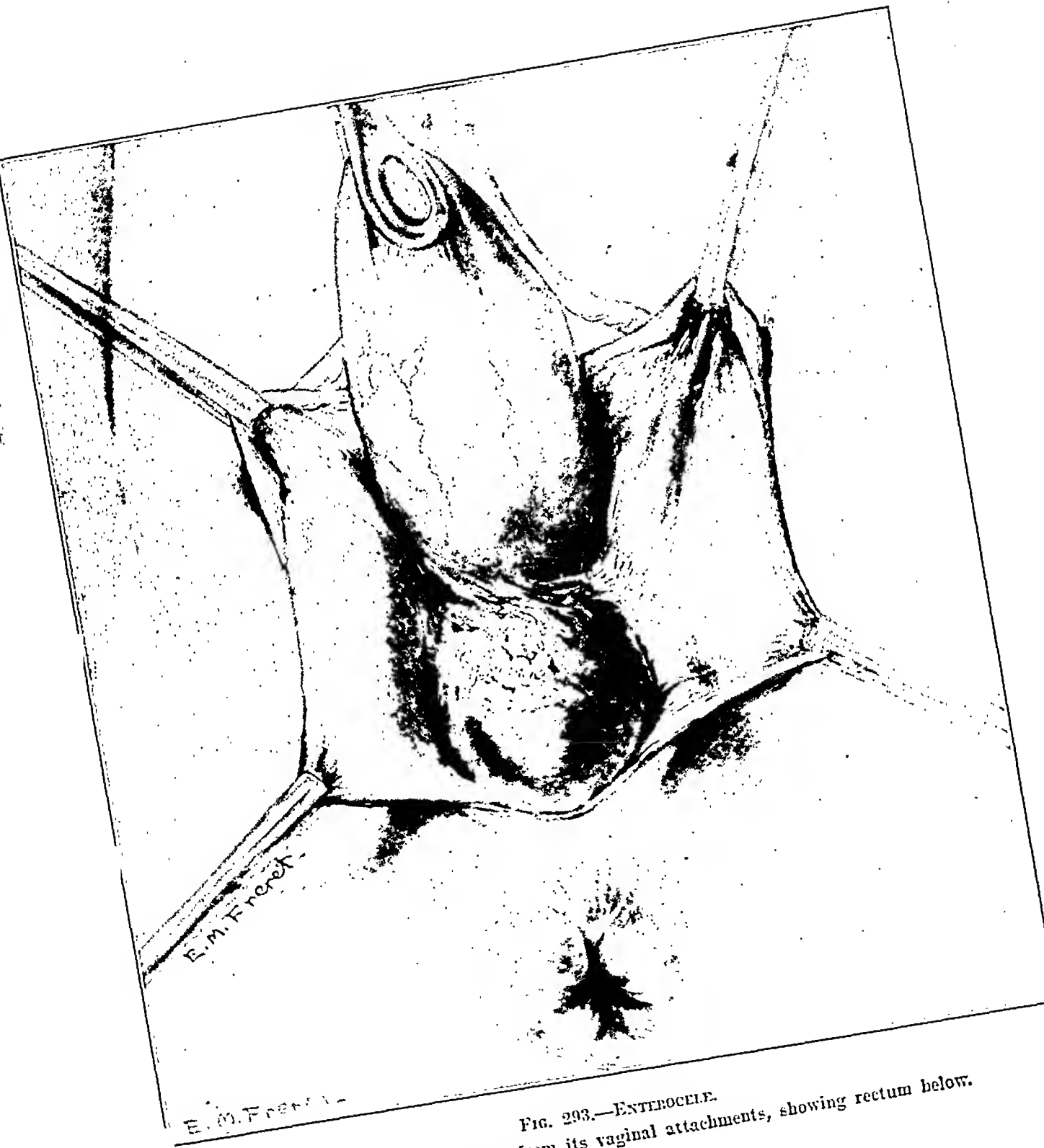


FIG. 293.—ENTEROCLE.
Pouch of Douglas dissected from its vaginal attachments, showing rectum below.

vaginal or abdominal route, as part of the technique in operations for uterine prolapse (G. G. Ward, *J. Am. M. Ass.*, Aug. 26, 1922). In enterocele without uterine prolapse, the posterior vaginal wall is opened in the midline for its

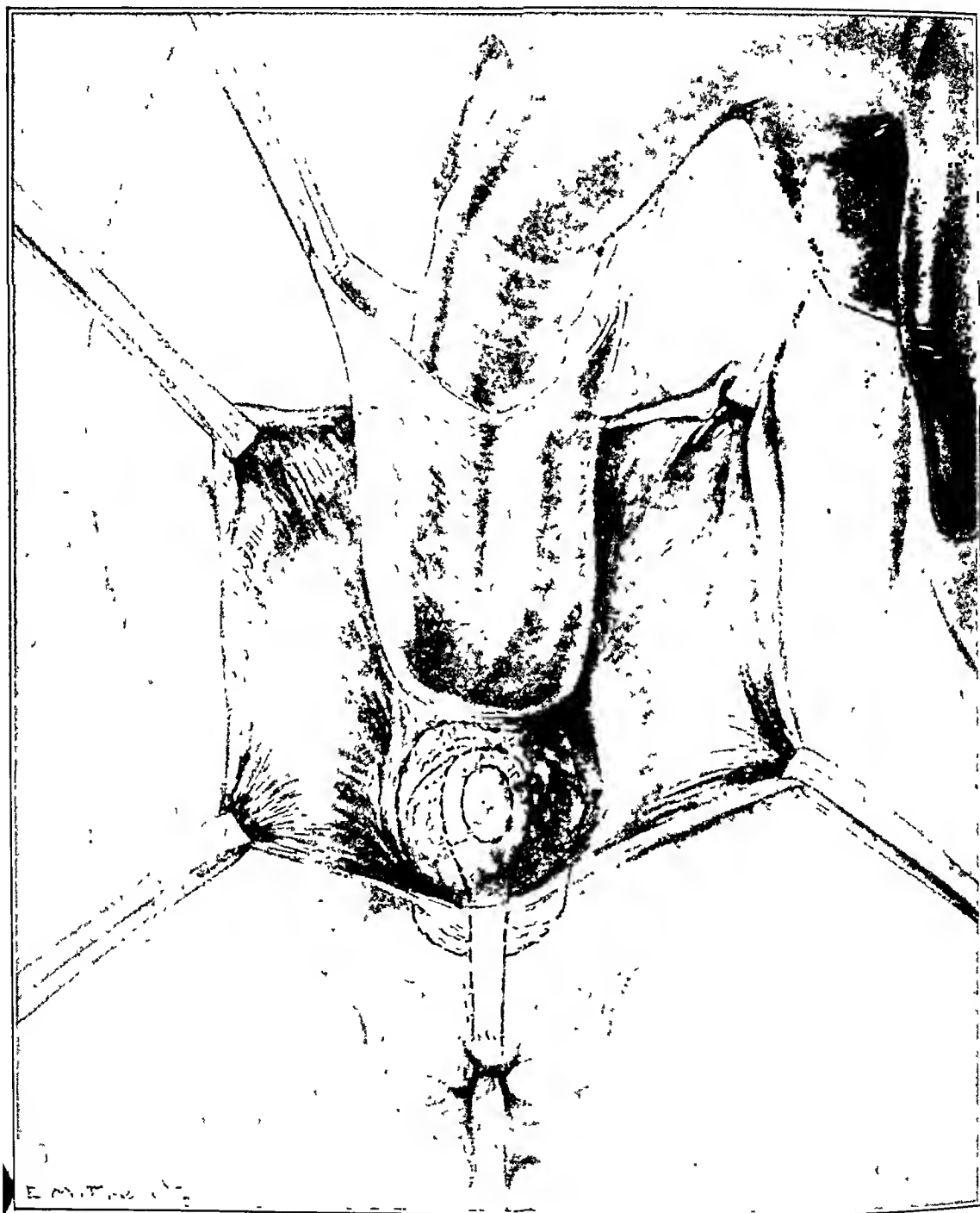


FIG. 294.—ENTEROCELE.

Pouch of Douglas opened and finger inserted. Sponge forceps in rectum shows relation.

entire length, and the peritoneal sac is dissected free up to the uterosacral ligaments, a sponge stick in the rectum serving as a guide, Figure 294. The sac is ligated and cut off, and the uterosacral ligaments united with interrupted linen

sutures as close as possible to the rectum. Figure 296. The denuded space is obliterated with continuous buried catgut sutures, and the vagina closed as usual. In the event of an associated uterine prolapse, in which the Mayo tech-

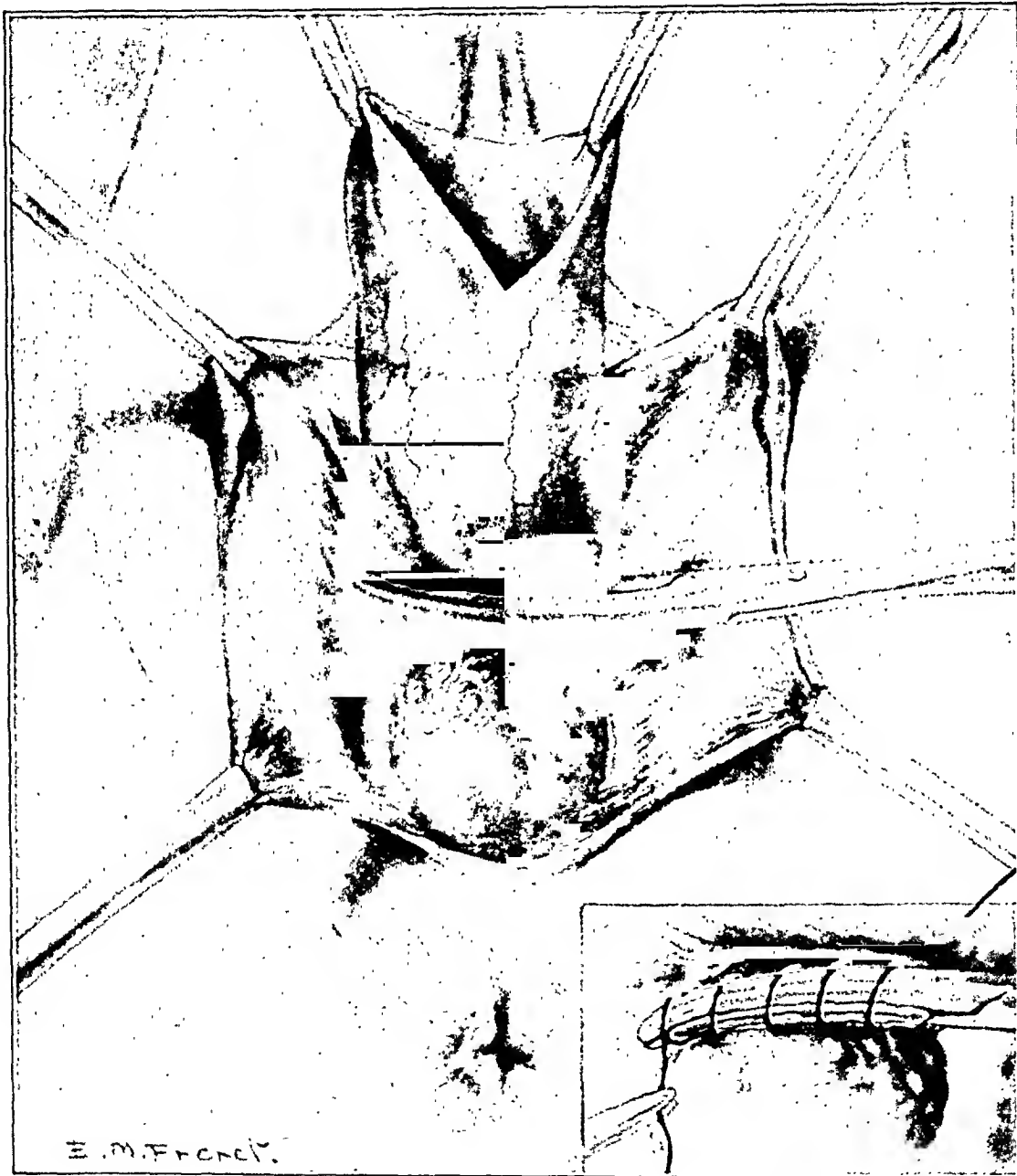


FIG. 295.—ENTEROCELE.

Peritoneal pouch of Douglas dissected out, opened, clamped, and ligated.

nique is employed, the obliteration of the culdesac is easily effected after cutting the uterus away from the broad ligaments. A finger in the pouch demonstrates its exact location and a median vaginal incision exposes the sac for an easy dissection up to the region of the uterosacral ligaments, where it is closed by a

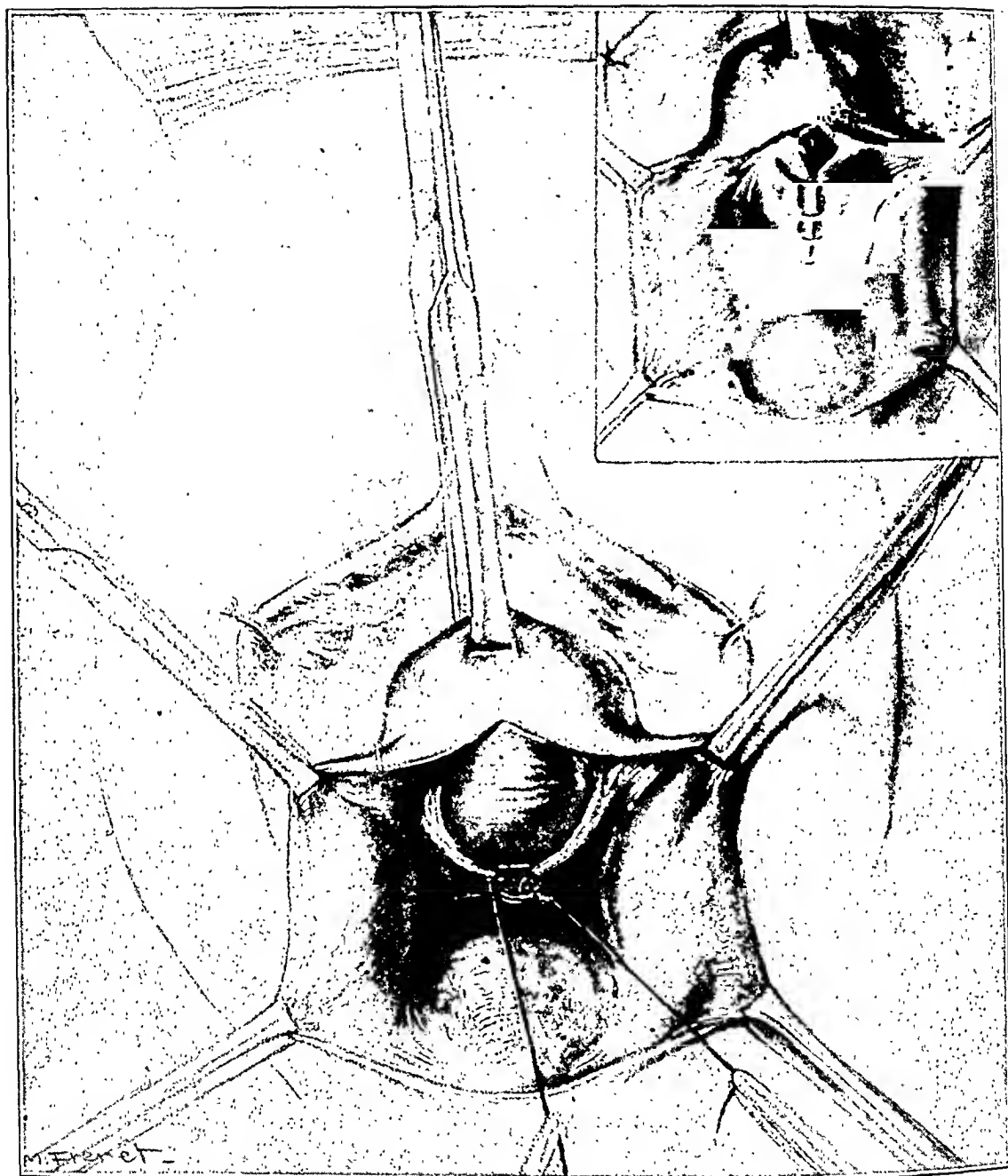


FIG. 296.—ENTEROCELE WITH UTERUS RETAINED.

Uterosacral ligaments united with interrupted linen sutures, closing entrance to culdesac; continuous catgut sutures obliterate space.

suture and cut off. The uterosacral ligaments are then united with linen sutures and the denuded area closed with continuous buried catgut sutures. After the obliteration of the culdesac the broad ligaments are sutured together and inter-

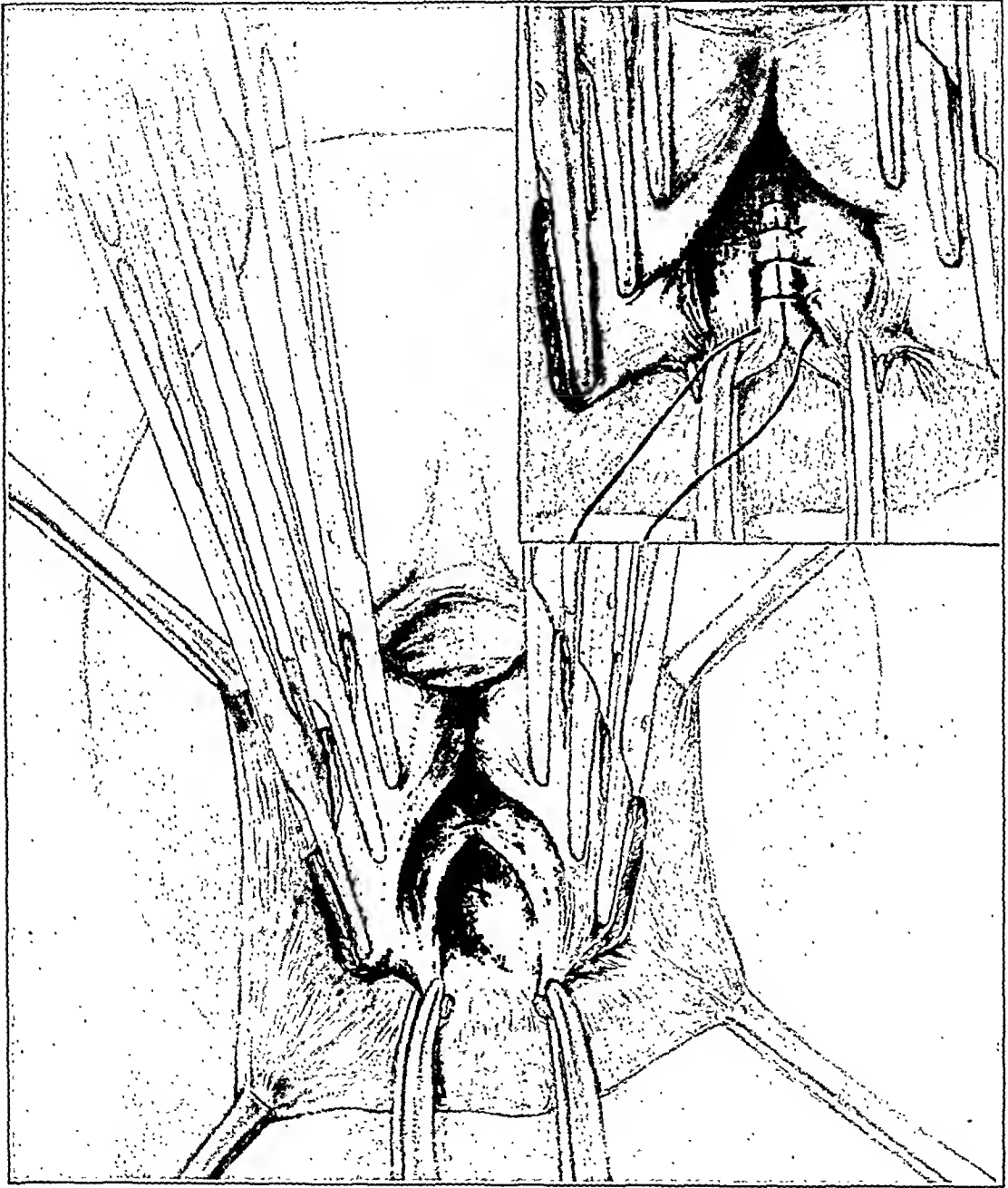


FIG. 297.—ENTEROCELE WITH UTERUS REMOVED.

Clamps on broad ligaments; interrupted linen sutures unite uterosacral ligaments after removal of the peritoneal pouch of Douglas.

posed beneath the bladder as usual; a perineorrhaphy completes the operation. The obliteration of the culdesac can be accomplished similarly from above when an abdominal operation is indicated.

CHAPTER XXI

TUMORS OF THE VAGINA

LEO BRADY

CYSTS

Epithelial Inclusion Cyst
 Vaginal Gland Cyst
 Embryonic Epithelial Structure Cyst
 Other Cysts
 Diagnosis
 Treatment

BENIGN SOLID TUMORS

Myoma
 Adenomyoma

MALIGNANT TUMORS

Carcinoma
 Sarcoma
 Chorio-Epithelioma

With the exception of cysts, new growths of the vagina are rare. They arise from the epithelium or from the fibromuscular structures.

CYSTS

Vaginal cysts are fairly common, resulting from (1) epithelial inclusions in scar tissue following tears or perineal operations, (2) vaginal glands, or (3) embryonic epithelial structures in intimate relation to the vagina.

Epithelial Inclusion Cyst.—The majority of inclusion cysts are small, 5 millimeters to 2 centimeters in diameter, and are found in the posterior or lower lateral wall of the vagina often embedded deeply but usually forming a rounded translucent eminence, Figure 298, or a small yellow nodule. The walls are thin, the inner surface smooth, and often filled with a substance resembling inspissated pus but in reality accumulated exfoliated epithelium. The lining is



298.—VAGINAL CYST
 OCCURRING THREE YEARS
 AFTER REPAIR OF PER-
 INEAL TEAR.

This cyst, containing clear fluid, was lined by several layers of squamous epithelium. Probably an inclusion cyst.

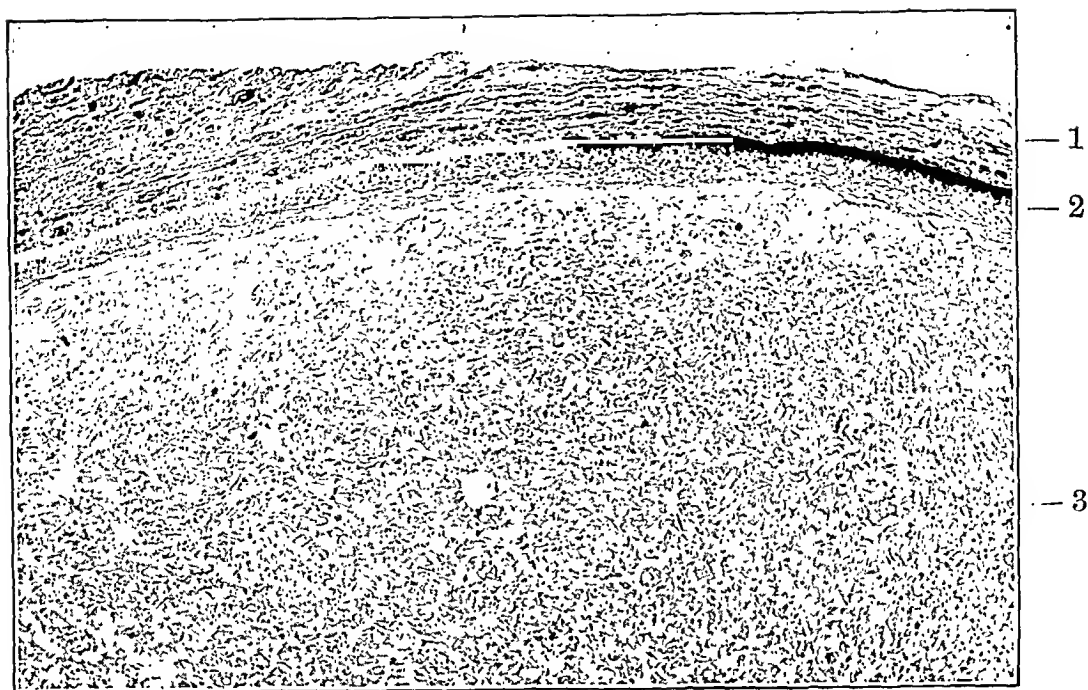


FIG. 299.—VAGINAL INCLUSION CYST.

1. Loose tissue of vaginal wall excised with cyst.
 2. Lining squamous epithelium.
 3. Débris of desquamated epithelium filling cyst.
- (J. H. U., Gyn.) $\times 20$.

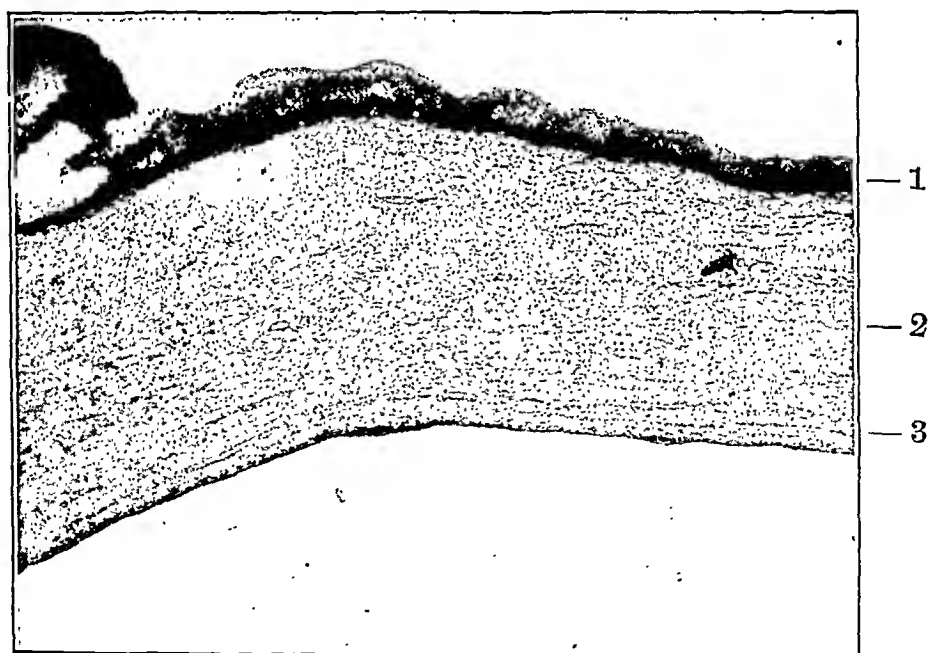


FIG. 300.—GARTNER'S DUCT CYST.

1. Normal vaginal epithelium.
 2. Vaginal wall compressed by presence of cyst.
 3. Lining epithelium of cyst, flat because of compression; in small cysts without compression, epithelium often clear columnar.
- (J. H. U., Gyn.) $\times 20$.

stratified squamous epithelium, or, if the upper layers are cast off, a single layer of cuboid or low columnar cells.

Vaginal Gland Cyst.—Cysts of the vaginal glands are apparently rare, but are so difficult to differentiate from inclusion cysts that the relative frequency remains uncertain.

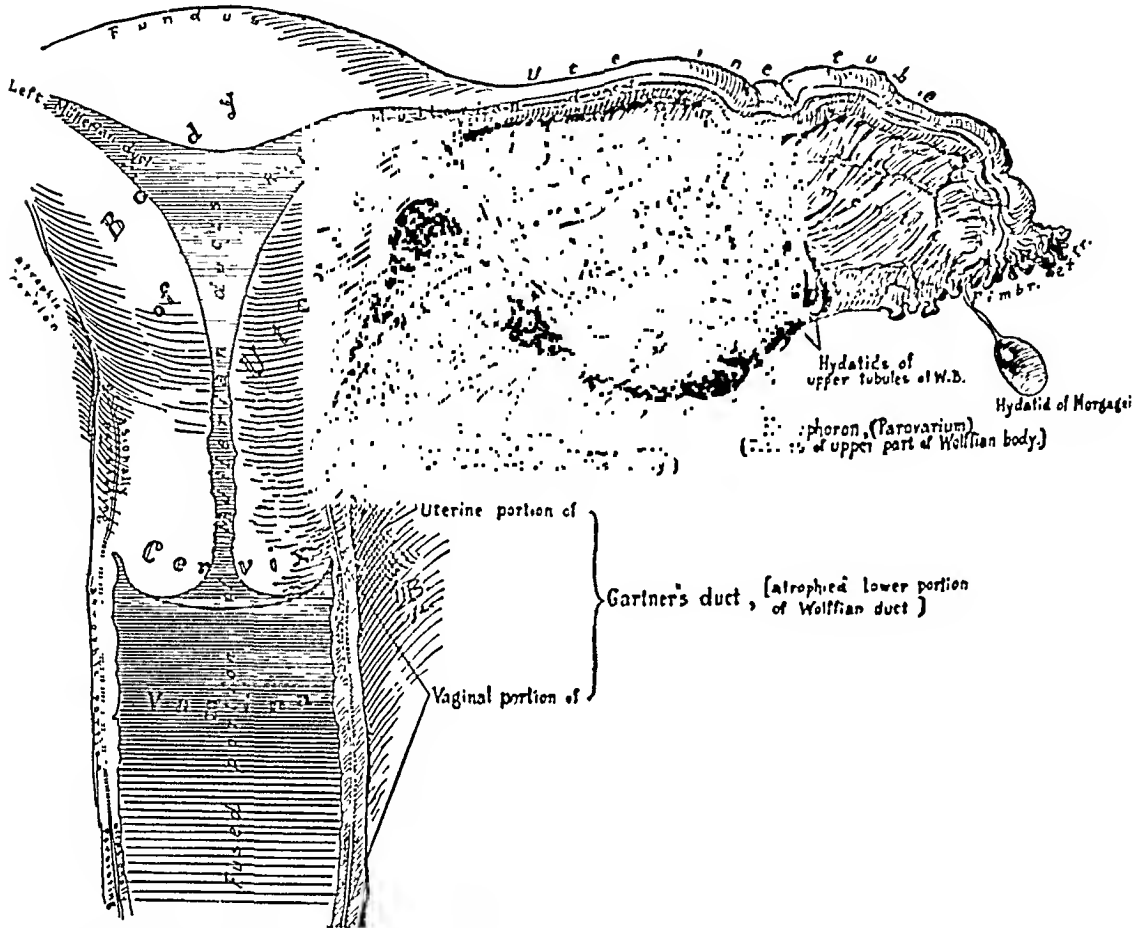


FIG. 301.—SCHEMATIC ILLUSTRATION OF UTERUS, TUBES, AND VAGINA, AS WELL AS OF RELATIONS OF WOLFFIAN AND GARTNER'S DUCTS TO BROAD LIGAMENT, UTERUS, AND VAGINA.

Outer portion of Müller's ducts form uterine tubes. Middle portions unite to form uterus; distal portions form vagina. In broad ligament, between tube and ovary, we see epoöphoron or parovarium, composed of many corkscrew-shaped tubules and communicating along upper extremities with collecting duct. They represent tubules of lower wolffian body. Lying imbedded at inner side of hilum of ovary are fragments of tubules and glomeruli of upper part of the wolffian body. In the drawing, Gartner's duct can be traced down through broad ligament into uterus near internal os and followed through outer portions of cervix to vagina. As a rule, vaginal, uterine, and inner broad ligament portions disappear. (T. S. Cullen.)

The existence of sparse vaginal glands long questioned, now seems assured on good clinical evidence. Globular or ovoid cysts form at any point but oftener above; they are translucent or turbid and lined either with squamous epithelium from the duct or with ciliated cylindric cells.

Embryonic Epithelial Structure Cyst.—Cysts in embryonic epithelial structures, persisting in the vagina, form a most interesting group; they originate either in Gartner's duct, Müller's duct, or a misplaced ureter.

Gartner's duct represents the remains of the wolffian duct homologous with

the parovarian tubules. In the embryo, the duct lies in the broad ligament, at the side or in the substance of the uterus and then applies itself to the lateral vaginal wall and terminates near the vaginal outlet, Figure 301. It usually disappears but sometimes remains traceable throughout its length. Remnants are commoner as one or more disconnected segments along the lateral vaginal wall. These isolated links may become cystic through accumulating secretions. A single cyst may develop, or three or four form in a line on the lateral or anterior vaginal wall, varying in size from a few millimeters to a tumor blocking the vagina. The covering is vaginal mucosa, but the walls proper are composed of fibrous tissue sometimes intermingled with bundles of nonstriated muscle-fibers.

When Müller's ducts fail to fuse in midline, there is a didelphic condition of two uteri and vaginæ. In other instances, partial but not complete fusion

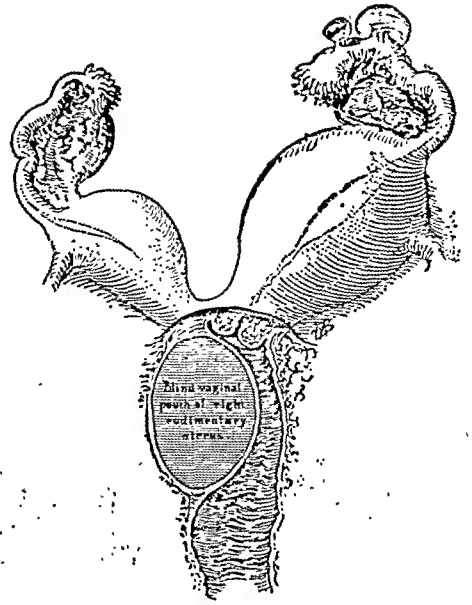


FIG. 302.—RUDIMENTARY VAGINA IN WALL OF WELL-FORMED VAGINA.

Schematic illustration of blind vaginal pouch due to imperfect union of Müller's ducts. Left uterus well-developed and its corresponding vagina perfectly formed. Right uterus rudimentary and its cervical portion represented by a solid cord. Vagina seen as blind cystic pouch. Such cavities may collapse, but if distended contain quantities of exfoliated squamous epithelium. (T. S. Cullen.)

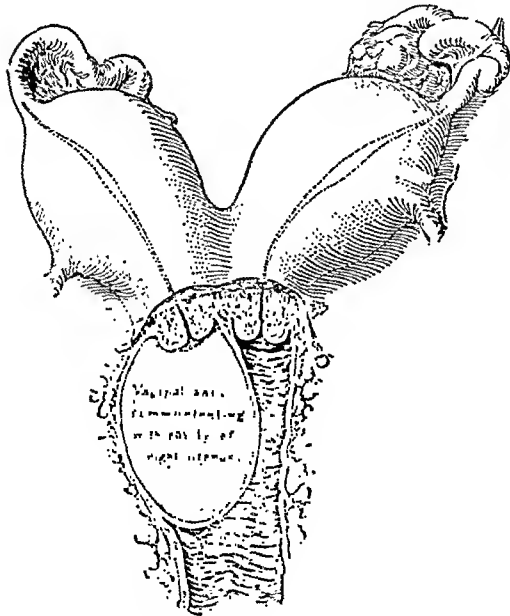


FIG. 303.—BLIND RIGHT VAGINA COMMUNICATING WITH WELL-DEVELOPED RIGHT UTERUS. VAGINAL CYST FORMED IN RIGHT FORNIX BY GRADUAL ACCUMULATION OF MENSTRUAL SECRETIONS.

takes place when we may have one well-developed uterus with a second imperfectly formed organ. The corresponding vagina unites with the lateral wall of the well-developed organ and secretions may accumulate to form a cystic tumor springing from the lateral vaginal wall, Figure 302. When the associated uterus is fairly developed and communicates with the sac, the retained menstrual blood distends the blind vaginal pouch, Figure 303.

A cyst of the vagina due to a misplaced ureter is recognized by its urea content. It is commoner with a double ureter. Where two ureters and two kidneys are found on one side, the ureter from the lower kidney is usually

inserted at the normal site while the one connected with the upper kidney is carried down further with the wolffian duct and is inserted more centrally and nearer the inner urethral orifice. It is only necessary for the second ureter

to be carried a little further on to have it open into or form a blind pouch in the vagina.

Other Cysts.—Echinococci are rare. Gas cysts (colpitis emphysematosa), Figure 304, are usually found in pregnancy; a puncture creates a little explosion and treatment other than cleansing douches is unnecessary as the condition is of short duration.

Diagnosis.—The majority of cysts are small and give rise to no symptoms and are accidentally detected during an examination. Moderate-sized cysts may cause dyspareunia, while larger ones have proven a barrier to delivery. A cyst located in the posterior wall is easily mistaken for an abscess of the rectovaginal septum, but the extreme tenderness of the latter facilitates diagnosis. The cystlike diverticula from the urethral floor are distinguished by pressure which forces pus out at the urethral orifice.

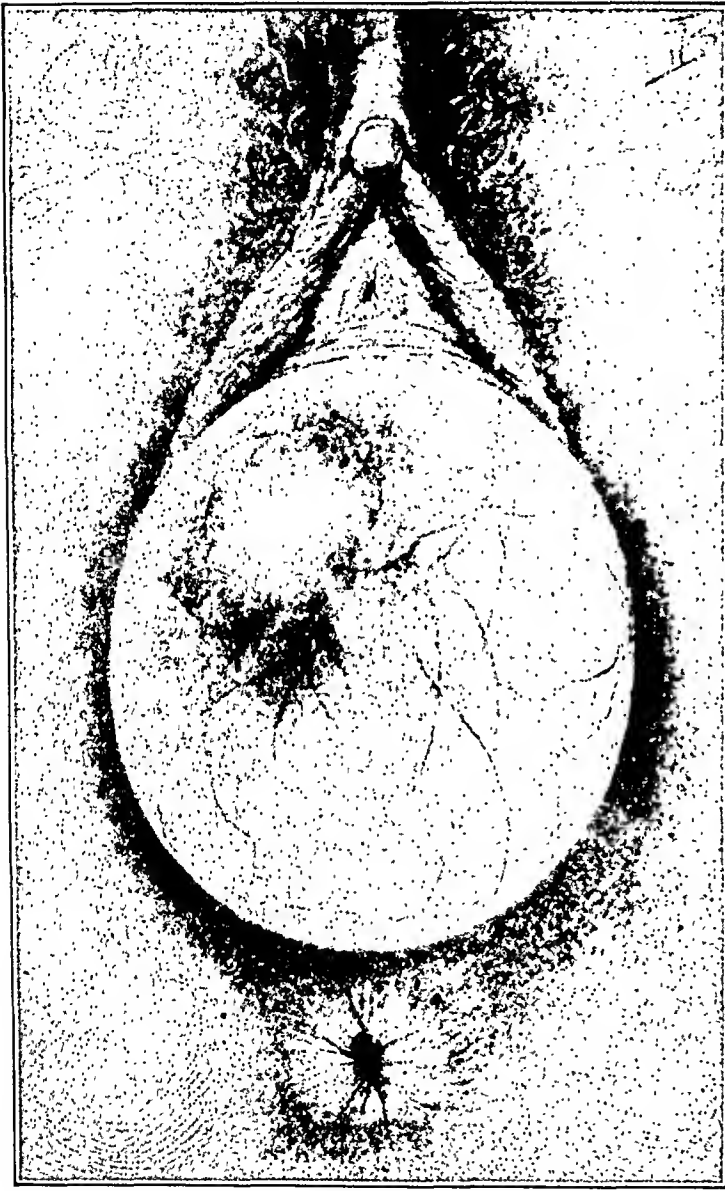


FIG. 304.—CYST OF ANTERIOR VAGINAL WALL OCCURRING IN PREGNANCY.

Entire cyst translucent, with whitish bands interlacing over surface. Note well-defined blood-vessels. $\times 1$.

Treatment.—A small cyst low down is easily excised or incised and treated with the high frequency current. The mucous membrane covering a larger true vaginal cyst is carefully incised until the cyst wall proper is exposed, when the tumor is enucleated by blunt dissection and all oozing stopped and the wound closed with fine catgut. When the cyst is large, the danger of wounding the ureter, bladder, or rectum is avoided by sticking close to its

periphery as it is dissected out. It is sometimes simpler to open and empty the cyst and then let it heal by granulation after sparking the interior out of existence. A parovarian cyst of Gartner's duct would also be best treated, if the enucleation promises to be difficult, by electrocoagulation.

BENIGN SOLID TUMORS

Myoma and adenomyoma are practically the only benign solid tumors found in the vagina.

Myoma.—Myomata arise in the smooth muscle tissue of the vaginal wall as polypoid pedunculate growths or as more diffuse tumors with wide basal attachments in the vaginal connective tissue. They are prone to necrosis, sloughing, and infection, and occasionally become malignant. The symptoms depend on the increasing size of the growth and the obstruction of the passage. There is a sense of weight and vesical tenesmus and sometimes partial retention. Constipation and rectal tenesmus may develop, and pain on coitus is an early symptom. Infection and sloughing produce foul leukorrhea.

The treatment is enucleation. Pedunculate tumors are easily amputated, the vessels controlled, and the base sutured. A large tumor with a wide base calls for a large vaginal opening, bisection of the tumor, and enucleation.

Adenomyoma.—Adenomyomata of the rectovaginal septum are considered with endometrial implants (Chapter XXXIX) and form the most important group in this area. At times differentiation is difficult from other benign and malignant vaginal growths, rectal growths, and metastatic tumors starting in the cervix. The presence of old menstrual blood, uterine glands, and the characteristic puckering of the overlying vaginal mucosa, with a history of increased pain during the menses, help establish a clinical diagnosis. For treatment of adenomyomata see Chapter XXXII.

MALIGNANT TUMORS

Three types of malignancy are found: carcinoma, sarcoma, and chorioepithelioma.

Carcinoma.—Carcinoma due to the extension of a cancer of the cervix is common and often calls for the removal of a large cuff of the upper vagina along with the uterus in hysterectomy, Figure 305. Again, one sees occasionally a hard nodule in the vaginal wall metastatic from a cancer of the uterine body. Primary vaginal cancer is rather rare and usually starts on the posterior wall. The initial stage may be single or multiple warts, an elastic nodule, or a flat infiltration. A fungating mass readily breaking down and bleeding is characteristic. Another form is a granular ulcerated area with infiltrated margins. Still rarer is a carcinomatous infiltration, rigid and contracted.

Carcinoma usually originates in the squamous epithelium; when adenocarcinomatous in type, it is thought to spring from congenital cysts or gland inclusions of the vaginal mucous membrane. It is asserted that the trauma of a pessary may bring it about, but, on the other hand, it is striking to see

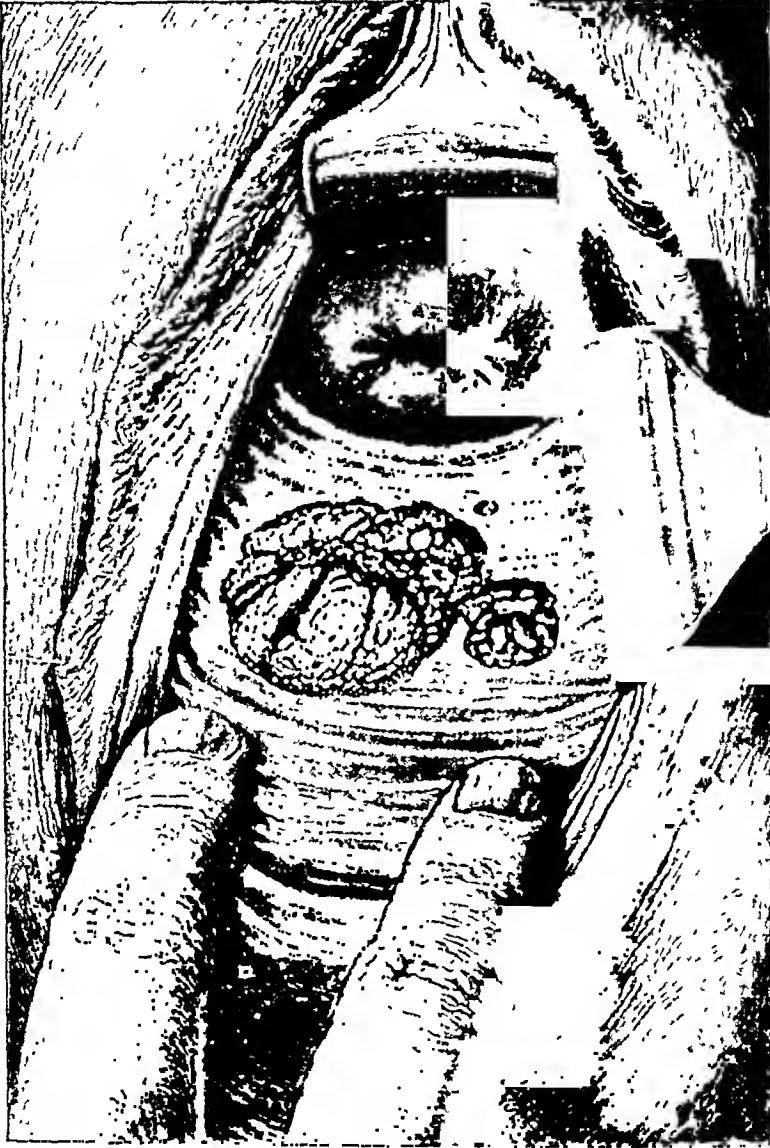


FIG. 305.—ADENOCARCINOMA OF POSTERIOR VAGINAL WALL BY IMPLANTATION FROM UNSUSPECTED ADENOCARCINOMA OF BODY OF UTERUS.

pessaries worn for ten years or more embedded in the hyperplastic inflammatory tissue without any resultant malignancy.

The symptoms are a foul discharge, hemorrhages, dull aching pain, and difficulty in defecation and micturition. Ulceration invades the rectum and the bladder. The broad ligaments, ureters, and ovaries are involved by extension.

The diagnosis of primary carcinoma is easy until the cervix becomes involved when the question as to the original seat becomes debatable. 'One must

TUMORS OF THE VAGINA

always assume, until the contrary is proved, that there is a vaginal implantation from an endometrial growth.

Radical operation is unfavorable; following it, the disease progresses rapidly and throws out metastases into tubes, ovaries, kidneys, liver, lungs, and bones, and the average duration of life is only a little more than sixteen months. Longer immunity has followed extensive early operations, but it is doubtful if any cure has been recorded until the advent of radium which is remarkably effective in the early stages (Chapter XLIV) and a valuable palliative later.

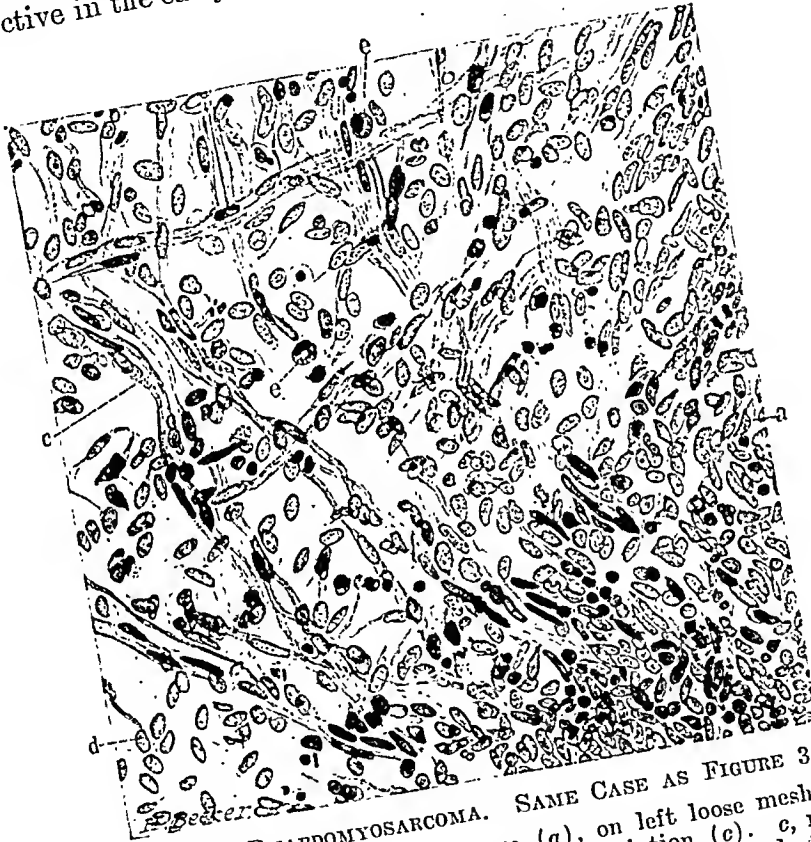


FIG. 306.—RHABDOMYOSARCOMA. SAME CASE AS FIGURE 307. On the right side cellular sarcomatous tissue (a), on left loose meshwork consisting of long ribbonlike fibers with longitudinal and transverse striation (c). c, mitosis; d, indifferent embryonic cells; e, eosinophiles. (Kelly-Noble, *Gynecology and Abdominal Surgery*, W. B. Saunders Co.) $\times 400$.

Sarcoma.—Sarcoma, rare in adult life, is more frequent in early childhood when it is apparently congenital. A few sarcomata have been noticed at birth; others develop during the first few years. The tumors in infants contain myxomatous tissue and smooth and striated muscle-fibers with sarcomatous metaplasia; by some they are considered not true sarcomata but mixed tumors related to the teratoid group, Figure 306. They are especially characterized by the development of clusters of dark red hemorrhagic and pinkish-gray translucent vesicular polypi, Figure 307. The growth first appears as a small pedunculate polyp, when the diagnosis can be made with the microscope. In a child the first symptom is apt to be a tumor in the vulvar cleft; in

adults, leukorrhea and pain and bleeding may attract the attention. A characteristic feature of the extension is the frequent penetration of the vesico-vaginal septum and the formation of an intravesical herniated mass. Vesical distress appears early. There is necrosis and foul discharge with an infection speedily fatal. Pyometra, purulent peritonitis, cystitis, and pycelonephrosis are concomitants.

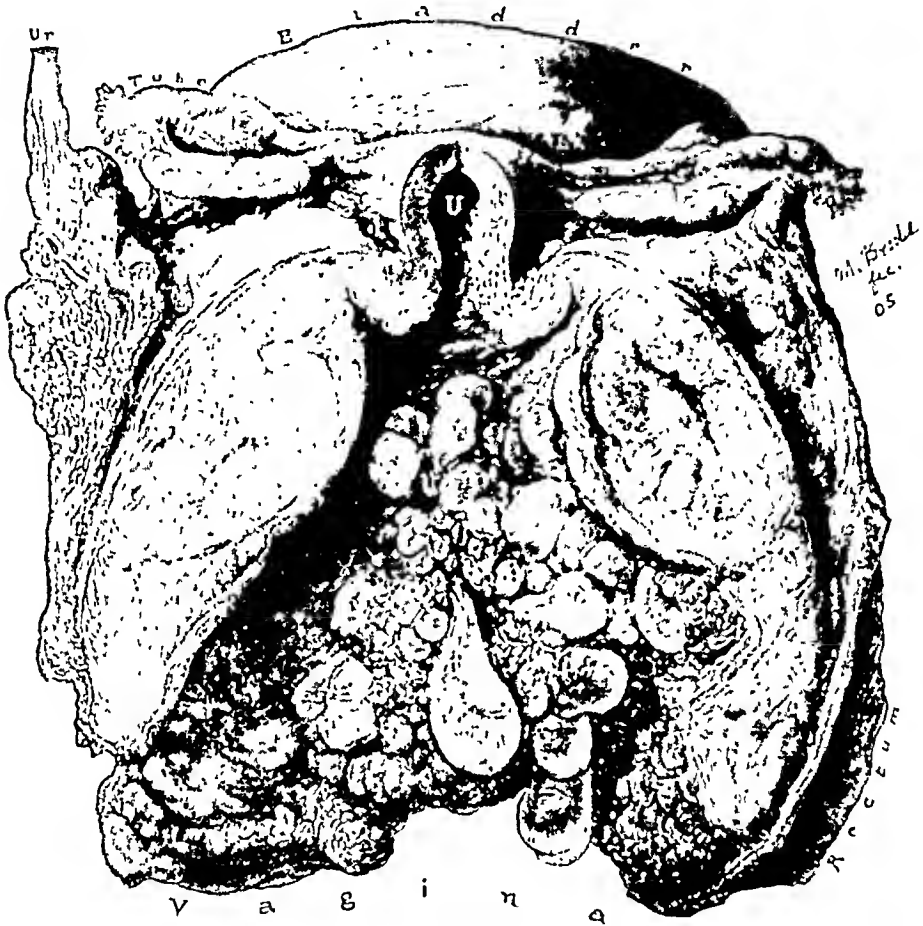


FIG. 307.—SARCOMA OF VAGINA IN CHILD $2\frac{1}{2}$ YEARS OLD (RHABDOMYOSARCOMA).

Grapelike polypoid masses in vaginal canal, infiltrated vaginal walls, and distended globular bladder. (C. Cone.) (Kelly-Noble, *Gynecology and Abdominal Surgery*, W. B. Saunders Co.)

The treatment is preëminently radiation, followed by operation if there is any residual mass.

Chorio-Epithelioma.—Chorio-epithelioma has often been observed, usually as a metastasis from the primary uterine neoplasm; rarely, the vagina alone is the site. It forms a dark red or brown mass with a fairly smooth or necrotic surface, histologically presenting the characteristic picture of the uterine chorio-epithelioma. Where the vaginal tumors are but extensions from a uterine growth, they have been known to disappear after the removal of the original focus; furthermore, even spontaneous cures have been reported.

CHAPTER XXII

GENERAL PRINCIPLES OF ABDOMINAL SURGERY

HOWARD A. KELLY

PRELIMINARY TO OPERATION

Consent of Patient

Health of Surgeon

Examination of Patient

Preparation of Patient

OPERATION

Visitors

Length of Incision and How to Find the Peritoneum

EXPLORATORY INCISION

INCISION IN FAT WOMEN

INCISION FOR TUBO-OVARIAN ABSCESS

Exposure of Field

Adhesions

Vesical Injuries

Ureteral Injuries

Ligation of Pedicle

Hemorrhage

Transfusion and Resuscitation

Drainage

Closure of Incision

Affections of Abdominal Incision

Abdominal Dressing

POSTOPERATIVE CARE

General Care

Nausea

Food

Thirst

Bladder

Bowels

Temperature

Pulse

Facial Expression

Sutures

Recovery

POSTOPERATIVE COMPLICATIONS

Shock

Secondary Hemorrhage

Pulse Peculiarities

Temperature

Vomiting

Tympanites

Excessive Pain and Sedatives

Parotitis

Pleurisy

Pneumonia

Ileus

Phlebitis

Embolism

Intestinal Hemorrhage

To avoid repetition, I present as a preliminary those principles and details which are common to abdominal operations in general.

PRELIMINARY TO OPERATION

Consent of Patient.—*Imprimis* it is always wise to get the patient's permission to do whatever the judgment of the surgeon may dictate in her best interest. If, on the contrary, the surgeon agrees to have his hands tied, as for example, promising under no circumstances to remove an ovary, he must abide by his promise unless in an extreme case the nearest relative assumes the full responsibility.

Health of Surgeon.—The surgeon's physical condition has much to do with the success of his work. I would insist that no man in ill-health ought to operate as he is unfit to endure the great and often prolonged strain, with frequent demands for clear judgment and a well-balanced nervous and muscular system not at the disposal of the semi-invalid. A surgeon with an acute tonsillitis, pharyngitis, ozena, alveolar abscess, furunculosis, pulmonary tuberculosis, or any febrile affection should hold himself debarred from abdominal operations on account of the risk of infecting his patient. It is improper for any one who has an elevation of temperature to approach the operating table. A suppurating wound on the hand also debarb surgeon, assistant, and nurse.

Some forty years ago, I lost a simple oöphorectomy for extreme dysmenorrhea, done for my friend, H. C. Wood, by operating unwittingly in the initial stages of an acute tonsillitis which immediately afterwards put me to bed for a week; at that time we were only beginning, taught by such tragic lessons, to suspect the cause of such a fulminating infection.

The surgeon also owes it to the patient, to himself, and to his profession to keep his body continually under discipline, avoiding excesses either in drinking or eating, not excluding fasting, in keeping regular hours with sufficient rest, and in living an exemplary moral life, inasmuch as all these things affect his judgment in his work and even his technical skill in performing an operation.

Examination of Patient.—Antecedent to every abdominal operation, a searching physical examination is indispensable for three obvious vitally important reasons: First, the particular local trouble may have extended to other organs, making an operation more dangerous or futile; second, the local disease may be secondary while the focus is elsewhere; third, independent of the pelvic disease, the patient often has some other affection greatly modifying the outlook or even contra-indicating operation.

This matter has assumed an enhanced importance during the last generation, through the gradual realization that distant focal infections are of the highest importance, often occupying a provocative relationship to pelvic disease and adding to our list of preliminary investigations the teeth, tonsils, and sinuses, as well as a routine Wassermann reaction which saves many an ugly situation, blood sugar in certain groups, and basal metabolism. If the surgeon cannot himself evaluate all these factors, he will do well to lean upon a trusted internist for coöperation and advice.

The lungs must be examined, the heart, the arteries, and the urine especially for diabetes. Gastric symptoms demand attention. A close inquiry into the former history will sometimes reveal a neurosis or even a more or less marked mental aberration. In a case in which I repaired the perineum, the emotional patient developed a profound melancholia lasting for months. Another, a pronounced neurasthenic, three weeks after a suspension operation, attempted suicide by cutting the abdomen with a broken bottle and about two months later cut her throat with a razor. If the family or a personal history reveals any such marked tendencies, the operator will at least work with his eyes open as to the risks assumed which he must then share with some responsible member of the family.

Without such a routine examination in each case, a life will now and then be lost from one or another unsuspected associated disease. Disease of an extrapelvic organ, likely to cause death in the near future, contra-indicates any but emergency work. This does not, however, prohibit operating for pelvic abscess in pulmonary tuberculosis, where there is a reasonable expectation of some years of life if the pelvic complication is removed. The results of careful work in the aged appear almost as good as in the young. (H. A. Kelly and Mary Sherwood, "One Hundred Ovariectomies in Women over Seventy," *Johns Hopkins Hosp. Rep.*, 1893, 3. Also *Surgical Diseases of the Ovaries*, J. Bland Sutton, 1896, who cites eleven ovariectomies in women over eighty, all recovering.)

It is my own custom, after a preliminary local and superficial general examination, to fill out a chart filed with the history, emphasizing the need of further close investigations and noting just what surgical procedures appear to be called for, thus obviating the risk of forgetting any minor but important details. For example, if a patient has had a hemorrhoid much on her mind, unless the gravity of, say, an abdominal operation has made it imperative to stop as soon as possible, often no explanation will pacify her when she finds that the surgeon has forgotten the hemorrhoid for which she may at some future date have to undergo another operation.

Preparation of Patient.—The object is threefold: To secure the best possible physical condition; to quicken the emunctories and evacuate the intestinal tract; and to spend a little time studying the patient herself as a distinct human entity, getting acquainted with her, and last but not least securing her confidence.

The amount of preparation must vary with the widely differing conditions. When the general health is good, often but one or two days may be needed to evacuate the intestinal tract and for bathing and cleansing the skin. When the matter is urgent, as in a cesarean section in an exhausted patient, all lengthy preliminary preparations must be cast to the winds, and the abdomen cleansed for the first and only time just before operating.

Cases of ruptured cysts with hemorrhage, ruptured pelvic abscess, ileus, appendicitis, or a ruptured ectopic gestation sac should almost be lifted from the stretcher on the street to the operating table.

When the patient is weak and anemic from a progressive disease, it is futile to delay in hopes of "building her up" for the operation, and but little time should be lost before removing the source of the deteriorated health.

Poor overworked women with abdominal tumors, pelvic abscesses, or other inflammatory diseases, in a depressed, run-down condition, only just escaped from the burden of exacting household duties and family cares, show a gratifying improvement with one or two weeks of preparatory rest in bed with a good diet and nutritious interval feedings. Daily baths and rubbings with cocoa butter are valuable adjuvants in restoring lost tone, not to forget some nights of good solid sleep, even though secured by a mild sedative.

Simon Flexner found in his analysis of the autopsy records in the Johns Hopkins Hospital that those who had chronic heart lesions, nephritis, and other chronic ailments were largely carried off by some terminal infection, demonstrating the value of bringing those with any chronic ailment into the best possible condition preparatory to any serious operation.

In the more timid pre-antiseptic days, no surgeon ever liked to give an anesthetic and to operate without a couple of weeks' or a month's preparation.

The extremely nervous and apprehensive must be managed differently, and the operation should, as a rule, be done within a couple of days after the announcement of its necessity in order to minimize the drawbacks of wakeful

nights, disturbed digestion, and agitated anticipations. It is wise sometimes to announce the operation just as the anesthetic is given, not, however, without a clear understanding with relatives or the responsible family doctor.

It is a wise general rule to take from three to four days to make the necessary preparations, in which time all problems connected with blood, urine, focal lesions, condition of other organs will have been worked out and the bowels well evacuated.

The presumption in pelvic tumors is that there is always a fecal stasis in the large bowel. One of the best purgatives is the old pill of aloes and mastich, the efficacy of which is thought to be vouched for by their patronym "Lady Webster"; give two each evening for two evenings before operation. Compound licorice powder (half an ounce) in tablet form, also acts well. As a final adjuvant, a low enema of soap and water may be given. With such preparations flatulence usually disappears.

Saline vaginal douches (sod. chlor. 2 teaspoonfuls to water 1 pint) or a 2 per cent carbolic acid solution should be given twice a day for any offensive or purulent discharge.

On the preceding evening give a general warm bath and insure a good night's rest.

Diet is important. Liquid diet increases the gas in the intestines; for two days before operation, give only meat and bread and butter, and on the preceding day soft-boiled egg and toast for breakfast, white meat of fowl and toast for dinner, and creamed sweetbreads and toast for supper. Between meals the patient may have beef juice and chicken broth. Fruits, sweets, vegetables, and milk are prohibited.

OPERATION

It is advantageous and a common thing in these days, though not in those of our forefathers, to do several operations on one occasion, removing a fibroid uterus or an ovarian tumor and an adherent appendix or even a gall-bladder. The major ailment should be attended to first and then if further delay is not dangerous, as when the patient is weakened by loss of blood, another operation of equal gravity may be added if in the surgeon's deliberate and best judgment it is wise.

The question of the operation is often literally a vital one. Many a patient is killed by a prolonged anesthesia before the operator begins, by slow operating, coupled with much handling of the intestines, with exposure and unnecessary loss of blood. The surgeon not always acutely conscious of the importance of these factors should yield his place to younger men more keenly alive to the control of the common elements making for success.

It may be laid down as a broad rule with many exceptions that an operation should be concluded in from a half hour to an hour.

A hypodermic of morphia $\frac{1}{8}$ to $\frac{1}{6}$ grain is a great help in giving courage and securing placidity and an adjuvant in the anesthesia.

I omit details common to all operations.

Visitors.—Visitors to the operating room should wear gowns and mouth covers and ought never to crowd up close to the operating table nor to brush against assistants or instrument and dressing tables.

Length of Incision and How to Find the Peritoneum.—The incision should enable the operator to command all parts of the field and to work as rapidly

as is consistent with due attention to details. Our predecessors dreaded a long incision. While Sir Spencer Wells showed in his *Ovarian and Uterine Tumors* (1882) that his mortality percentage where the incision did not exceed 6 inches was 20.65 and when it did exceed 6 inches was 39.43, with surgical insight he inferred correctly, "that the extent of the incision is little less than an indication of the gravity of the case, as it can not be supposed that two or three inches, more or less, of simple division of the parietes of the abdomen would augment the danger to this amount." The length of the incision in reality forms an index to the



FIG. 308.—EXCESSIVE LOWER ABDOMINAL OBESITY.

Commonest site for accumulation of fat, eminently suitable for lipectomy.

complications met and the duration of the operation. The day has long since passed when one was justified in exhibiting his dexterity by working through a short incision. The shortness of the incision should never restrict the manipulations within the abdomen. Difficult operations, such as the removal of large adherent tumors, pelvic abscesses, and other inflammatory masses, always demand a longer incision to facilitate easy inspection and a freer use of the hands.

Exploratory Incision.—An incision to evacuate ascitic fluid and for an exploration of the peritoneal cavity need not be over 3 or 4 centimeters long. With the escape of the fluid and collapse of the abdomen, one or two fingers are introduced to explore. An incision admitting the hand makes all the important abdominal organs accessible.

Incision in Fat Women.—If the abdominal walls are heavy and pendulous with fat, a much longer incision must be made, as the thick parietes tend to obscure every manipulation within the abdomen. In rare cases of enormous accu-



FIG. 309.—RESULT OF LIPECTOMY.
The mass of fat never reaccumulates in this site.

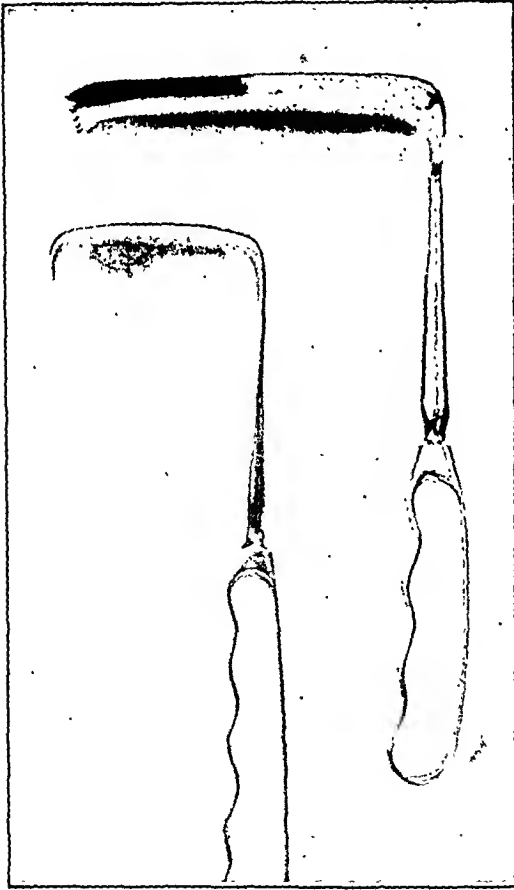


FIG. 310.—RETRACTORS.

Upper, with teeth, slightly concave, best form of deep retractor, perfectly exposing all parts of pelvic floor. Lower, also slightly concave, in several widths, forms an excellent retractor of abdominal walls. $\times \frac{1}{2}$.

mulations with an obscure diagnosis, great advantage is gained and the risk of suppuration forestalled by exploring through the umbilical ring where the wall is thin.

In dealing with a large, heavy, pendulous abdominal wall, the operation is greatly facilitated by excising a broad watermelon slice from side to side and resecting the fatty tissue down to the muscular wall of the lower abdomen. This not only helps the operator but adds enormously to the subsequent comfort of the patient, as the fat never re-

turns. The transverse skin and fat portion of the incision is closed by a few linen sutures, uniting a fascial layer found midway between the skin and muscular wall with some light chromic gut sutures between. The skin is closed as usual, with a little protective drain in each angle in the flanks, Figure 309.

Incision for Tubo-ovarian Abscess.—The incision for a tubo-ovarian abscess should be from 10 to 12 centimeters long, giving a better exposure and facilitating the various manipulations. As soon as the skin incision is made, it is wise for the sake of cleanliness and lessened risk of infection to clamp a towel or gauze pad all along the edge on both sides.

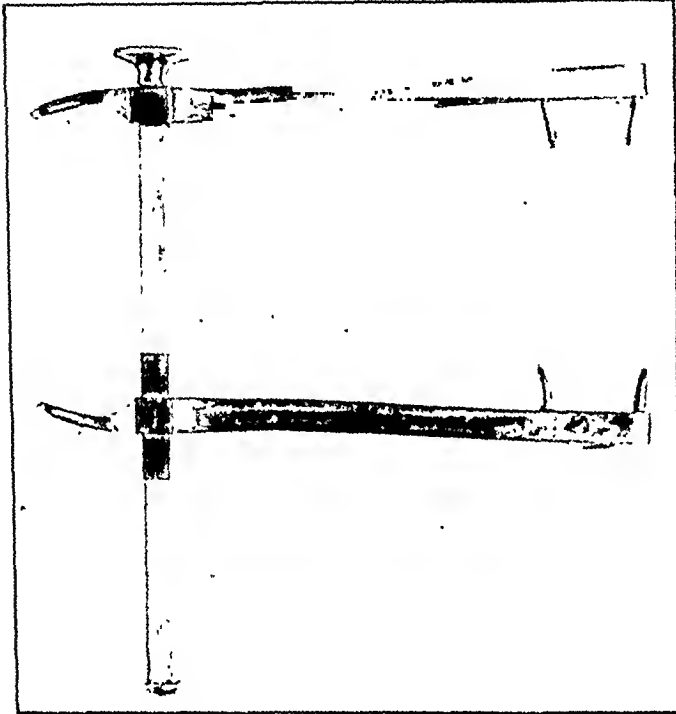


FIG. 311.—SELF-RETAINING RETRACTOR FOR ABDOMINAL INCISION. $\times \frac{1}{4}$.

Exposure of Field.—The elevation of the pelvis to facilitate displacement of the viscera up toward the diaphragm and the perfect exposure of the pelvic organs is a *sine qua non* in abdominal surgery. The advantages of this posture, now commonly called Trendelenburg's, were first appreciated by Bardenheuer of Cologne (*Die Drainirung der Peritonealhöhle*, Stuttgart, 1881, p. 276), as noted by E. Cushing.

Before this posture came into general use, much dexterity was acquired in manipulating the intestines, to keep them out of the field, with

fingers and sponges, and often when this failed they were lifted outside on the abdomen, exposed, and chilled, a not infrequent cause of shock and death.

The amount of elevation needed varies with the case. In stout women, where there is a redundancy of intra-abdominal fat, it may be necessary to raise the body to an angle of 45 degrees. But it must ever be borne in mind that an excessive elevation is dangerous, throwing too much strain on the diaphragm and the heart especially in a prolonged operation. There is also danger in the fact that the posture tends temporarily to check hemorrhage which then recurs after the abdomen is closed. Also, a loop of the small bowel may in this way readily slip through a hole in the omentum. If an abscess is ruptured unexpectedly, the table should be lowered at once to avoid the distribution of the pus.

Adhesions.—A common complication is viscera adherent to one another and to the parietes. One must always take care in opening the abdomen not to

cut into an adherent bowel or a large vein in an adherent omentum—accidents more likely to happen to a dashing operator. As soon as the peritoneum is opened, a little air rushes in and separates it from the underlying viscera, and the rest of the peritoneal incision is made by lifting up the edges and extending this small initial opening. It is best to open above the middle of the incision, especially when fibroid tumors crowd the pelvis, in order to avoid injuring a high displaced bladder.

On dropping the head of the table and elevating the pelvis and lifting up the abdominal walls with retractors, one begins by looking for adhesions and dividing all interfering with the perfect inspection of the field and in and about the pelvis. If the omentum is badly adherent anywhere, it is best cut off, leaving the attached part to protect the structure (T. S. Cullen).



FIG. 312.—STRICTURE OF RECTUM DUE TO PELVIC INFLAMMATORY DISEASE, SEEN THROUGH PROCTOSCOPE, 9.5 CENTIMETERS ABOVE ANUS. $\times 1$.

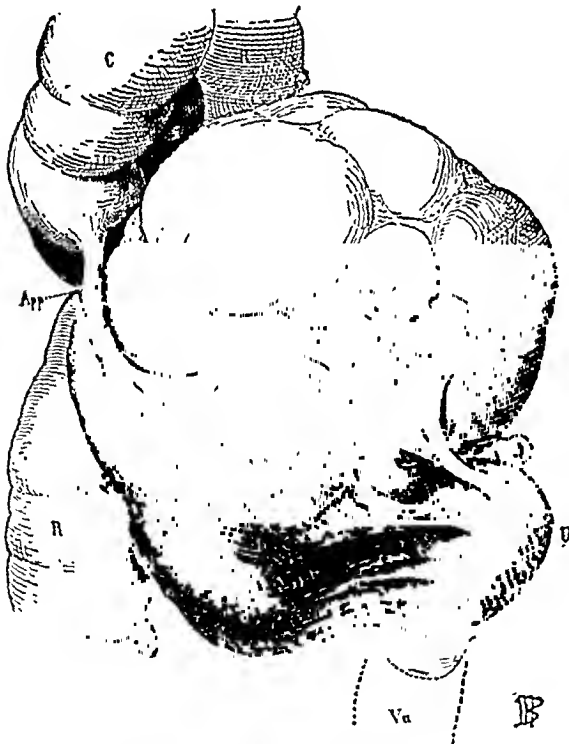


FIG. 313.—VERMIFORM APPENDIX (*App.*) ADHERENT TO LARGE PAPILLARY OVARIAN CYST. $\times \frac{2}{3}$.

Any widespread bowel adhesions may be attended to after completing the operation, when it is also often best not to undertake to separate too many loops of bowels unless there is a prospect of dealing with all the adhesions; to sever an adhesion here and there may only provoke an obstruction.

Pelvic adhesions are often easy to separate by gradually insinuating the fingers between the structures, working them with a shearing motion until the uterus and adnexa lie free and isolated in the center.

If an abscess is encountered, it is sometimes best to empty it with an aspirator and envelop it in a gauze napkin.

A bilateral pelvic inflammatory disease justifying the total ablation of the uterus with its tubes and

ovaries is usually better done by bisecting the uterus first (Chapter XXIV) and dealing with the abscesses last.

Dense bowel adhesions to benign tumors and cysts are treated by excising a little patch of the tumor and leaving it attached to the bowel.

The appendix vermiformis must always be borne in mind and whenever adherent removed, whether or not the adhesions connect it directly with the operation (Chapter XXVII), Figure 313. Often the patient will herself request the surgeon to be sure to take it out.

Vesical Injuries.—Vesical injuries, formerly common, should in these days be rare indeed; if the bladder is torn or cut it must be closed at once with fine chromic sutures in two layers. Accidents to the bladder must be guarded against in the larger myomatous uteri, Figure 314.

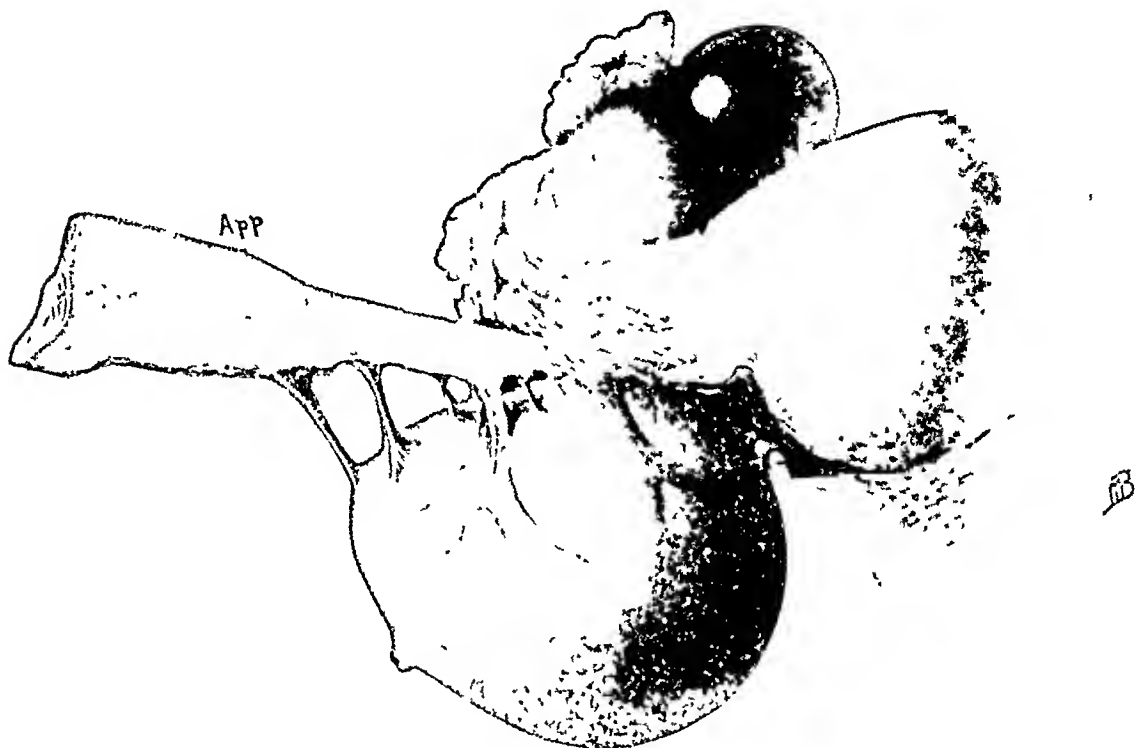


FIG. 314.—EXTENSIVE PELVIC INFLAMMATORY DISEASE WITH GENERAL ADHESIONS, DUE TO TUBERCULOUS ENDOMETRITIS, PELVIC PERITONITIS, TUBERCULOSIS OF BOTH TUBES AND OF RIGHT OVARY.

Right ovary is $5 \times 4 \times 3$ cm., filled with pus. Drawing especially intended to show densely adherent vermiform appendix. $\times 1$.

Ureteral Injuries.—Injury to the ureters is avoided by constantly keeping in mind their position as well as their possible displacement in large fibroid tumors or in a densely adherent suppurating tumor. The best place to find a ureter quickly is at the pelvic brim, following its course down into the pelvis where it crosses the common iliac artery and where one can note any distention by pressure and pick it up and follow its course down into the pelvis. Injury is also avoided by sticking close to the tumor in an enucleation and shelling it out of all its loose tissue investments.

The assurance that there is no injury is gained by examining each ureter by sight and touch thoroughly before closing the wound. If a ureter is divided,

provided it is a clean cut and the ends are easily accessible, they can be sewed together with fine silk sutures avoiding the lumen. Another plan (van Hook's) is to slit the lower ureter just below its cut end and then to pull the upper end into the slit and sew it there. The divided end of the lower part must be tied. If the lower portion of the ureter is too involved in disease, the best plan is to open the bladder at the nearest point and to sew the ureter into the opening. The easiest way to do this is to introduce a sound through the urethra and push up the bladder at the point nearest the ureter, open it there, and then pull the ureter in and sew the bladder well over it, making an oblique entrance.



FIG. 316.—FERGUSSON FORCEPS.

Best for handling tissues *en gros*. Made in three sizes, of which this is the smallest.

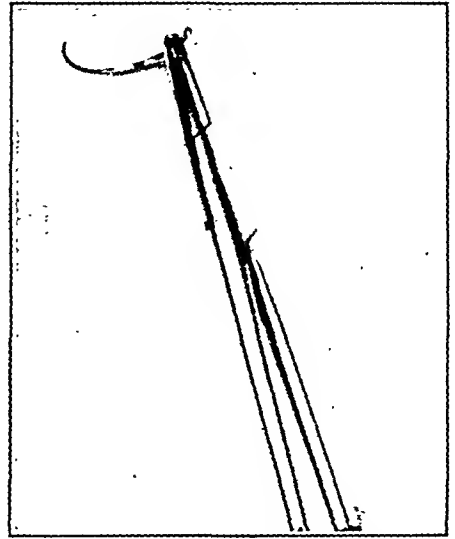


FIG. 315.—BEST TYPE OF NEEDLE HOLDER, GRASPING ROUND NEEDLE WITH SUITABLE EYE, FLATTENED UNDER EYE. $\times \frac{1}{2}$.

Ligation of the Pedicle.—Chromic catgut is the best material to tie off the pedicle of the pelvic tumor of intermediate size. It is fortunately unnecessary any longer to warn against using braided or heavy silk ligatures, formerly the cause of troublesome postoperative infection and even of fistulas.

It is best so far as possible to avoid mass ties and to ligate all larger vessels separately. If a pedicle is long and thin, a single ligature may control it. A thick pedicle must be transfixed and tied by two ligatures.

Avoid cutting the pedicle close to the ligature; also avoid cutting the ligature off close to the knot. Death from hemorrhage has resulted from a neglect of this latter precaution. I once saw a fine operation for inguinal hernia on a near relative utterly ruined by cutting the stout kangaroo tendon too short. The patient felt something give after two or three days when the whole disability recurred. One must be particularly careful in making a tie on the apex of a pyramid of tissue, often the seat of a serious postoperative hemorrhage.

At one time, Lawson Tait's Staffordshire knot was vaunted as a certain preventive of postoperative hemorrhage, but I saw the knot slip and a bad hemorrhage take place in a simple oöphorectomy in Tait's own hands.

A mass ligature to the cervix, including the uterine vessels, is also a relic of our early bungling efforts.

The ovarian vessels are best tied by transfixing an interval I call "the clear space" free from vessels at the outer extremity of the broad ligament and tying over the top of the broad ligament, Figure 318.

Hemorrhage.—In all radical operations upon uteruses, ovaries, and tubes, uncomplicated by adhesions, any serious hemorrhage usually arises from one or other of the uterine or ovarian vessels. Early extirpative operations, particularly upon large fibroid tumors, were sometimes accompanied by frightful hemorrhage, owing to the failure of the operator to realize that he only needed to control these several trunk vessels to prevent any serious bleeding.

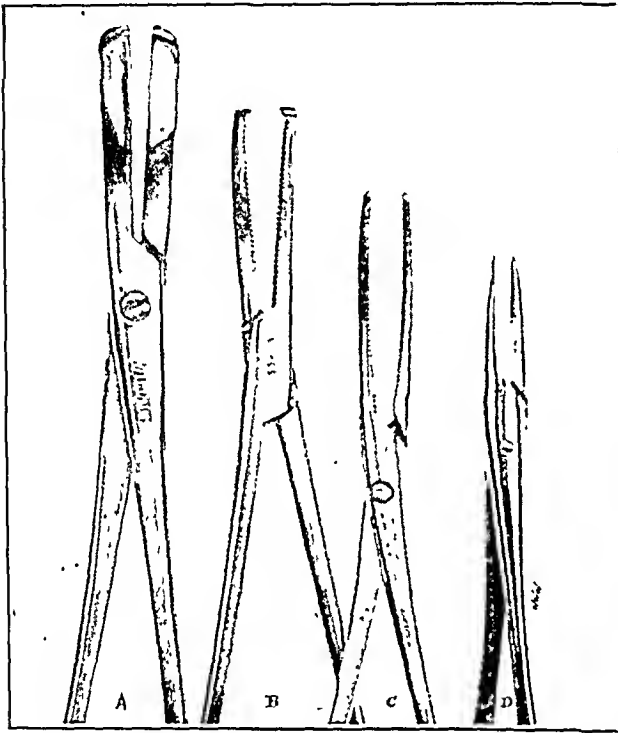


FIG. 317.—SEVERAL FORCEPS.

- A. Crushing for broad ligament, reducing tissue to ribbon.
 - B. Kocher-Ochsner, affording firm grasp of tissues.
 - C. Common tissue forceps.
 - D. Fine-pointed forceps for picking up vessels for coagulation or ligation.
- × $\frac{5}{8}$.

The definite ligation of these trunks, one by one, as the four essential steps, constitutes the sheet anchor of every hysterectomy.

Where the operation is apt to be prolonged, any loss of blood in a weak individual adds to the risk; the rule must be to clamp all bleeding vessels step by step as the operation advances.

As the incision into the abdomen is made, all bleeding vessels are caught with fine-pointed delicate forceps. The pelvic floor is a bad place for hemorrhage, always to be avoided by making a slow painstaking dissection under a good light. Hemorrhage from a soft sarcoma or a friable carcinoma of the ovary, beginning as soon as the abdomen is opened and the tumor is touched, is not infrequently best checked by plunging rapidly through the disease, liberat-

ing the tumor on all sides and lifting it quickly up and out of the abdomen to expose the pedicle which is at once clamped controlling the ovarian vessels at the pelvic brim and the vessels at the uterine cornu. The same procedure works well also in some extra-uterine pregnancies flooded with blood.

Continuous oozing from broad adherent surfaces on pelvic floor or walls can often be checked by the endothermic coagulation current sprayed over the area, producing a superficial slight cooking of the surfaces.

A firm gauze pack peripherally applied against the bleeding area with pressure and brought out into the vagina or at the lower angle of the wound,

also checks hemorrhage; it should be removed in twenty-four to thirty-six hours.

Transfusion and Resuscitation.¹—In the operating room, the anesthetizer stands next to the surgeon in safeguarding the patient whose life often depends upon his watchfulness, judgment, and promptness in action. He should have close at hand a tray ready for immediate use with sterile hypodermics of

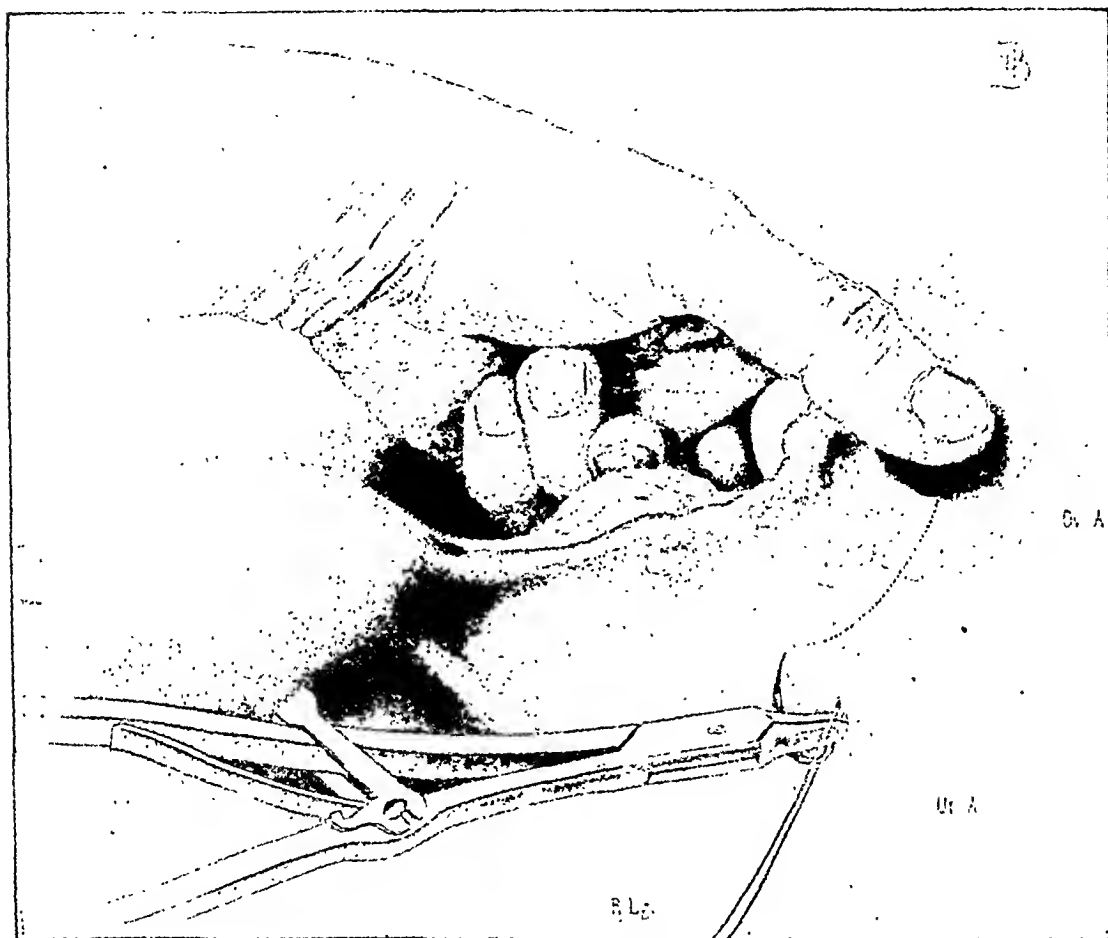


FIG. 318.—CLEAR SPACE.

By lifting up tube and ovary an area is developed in outer part of broad ligament where both layers of ligament come together. Index finger seen through clear space. By transfixing with needle, as shown, and tying over top of broad ligament in direction of dotted line, ovarian vessels are secured.

caffein benzyrate or camphor in oil, tongue forceps, jaw forceps, and sponge holders with sponges for incision in the throat. A printed chart records the amount of anesthetic given as well as the pulse and respiration every ten minutes; it is in order to report at once to the surgeon any marked change noted.

The preliminary examination of the patient on entrance includes besides

¹ Lilian K. P. Farrar of the Woman's Hospital of New York City contributes the section on transfusion and resuscitation.

the routine physical and laboratory examinations, the blood-pressure and blood type. The blood-pressure is taken before anesthesia and again at the end of the operation. The condition of the patient is estimated by any fall in the blood-pressure while operating or at the end of the operation; a drop of twenty-five or more points from the initial pressure recorded in the ward indicates shock. By using an apparatus with a large dial, the rate of blood-pressure is easily read at all times. There is often a drop or a rise before any change in pulse or respiration can be detected.

It has been the custom in the First Division, Woman's Hospital of New York City, for the past seven years to give 250 to 300 c.c. of gum acacia glucose solution intravenously when the blood-pressure drops twenty-five or more points. Sealed ampules containing the sterile solution are kept ready,

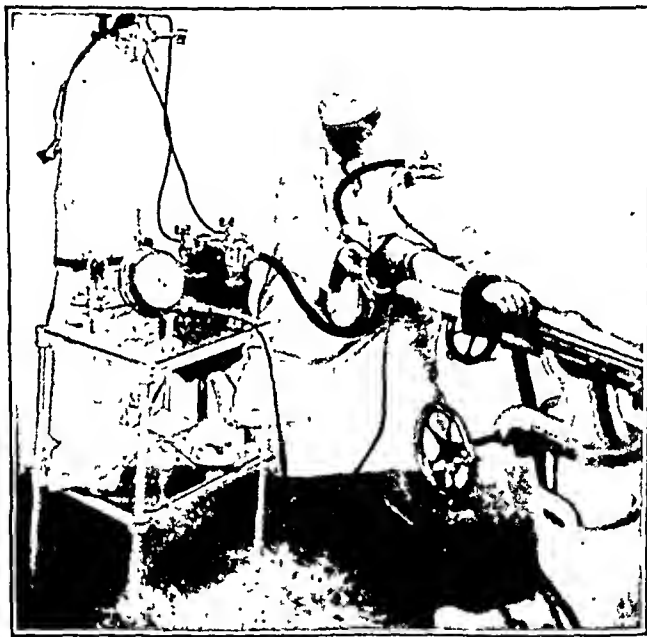


FIG. 319.—APPLICATION OF BLOOD-PRESSURE APPARATUS.

and a container with sterile needles and thermometer attached is ready for instant use. With a Y tube and a clamp on the rubber tubing, the rate of the flow is easily regulated. Four to five c.c. (according to body weight; *i.e.*, 4 c.c. per minute for a patient weighing from 100 to 150 pounds and 5 c.c. per minute for a patient weighing from 150 to 200 pounds) are given per minute at 105° F., temperature being maintained by hot-water bottles on the tube and below it, or by ether poured over the tube if necessary to cool the solution. A Bovée thermometer near the needle shows the temperature of the solution entering the vein. For poor-risk patients or in long operations, the gum glucose is started at the beginning and continued throughout the operation, maintaining the blood-pressure by the gum acacia and so lessening the fall in the alkali reserve (carbon dioxid) of the body and combating acidosis, as well as diminishing vomiting incident to the operation by the glucose supplied to the

liver. The rate per minute must not be increased as the amount of glucose thus given is based upon experiments by Woodyat and his coworkers, which showed that an individual absorbs 0.8 gram per kilogram of body weight per hour. More glucose becomes a diuretic and passes out of the system carry-

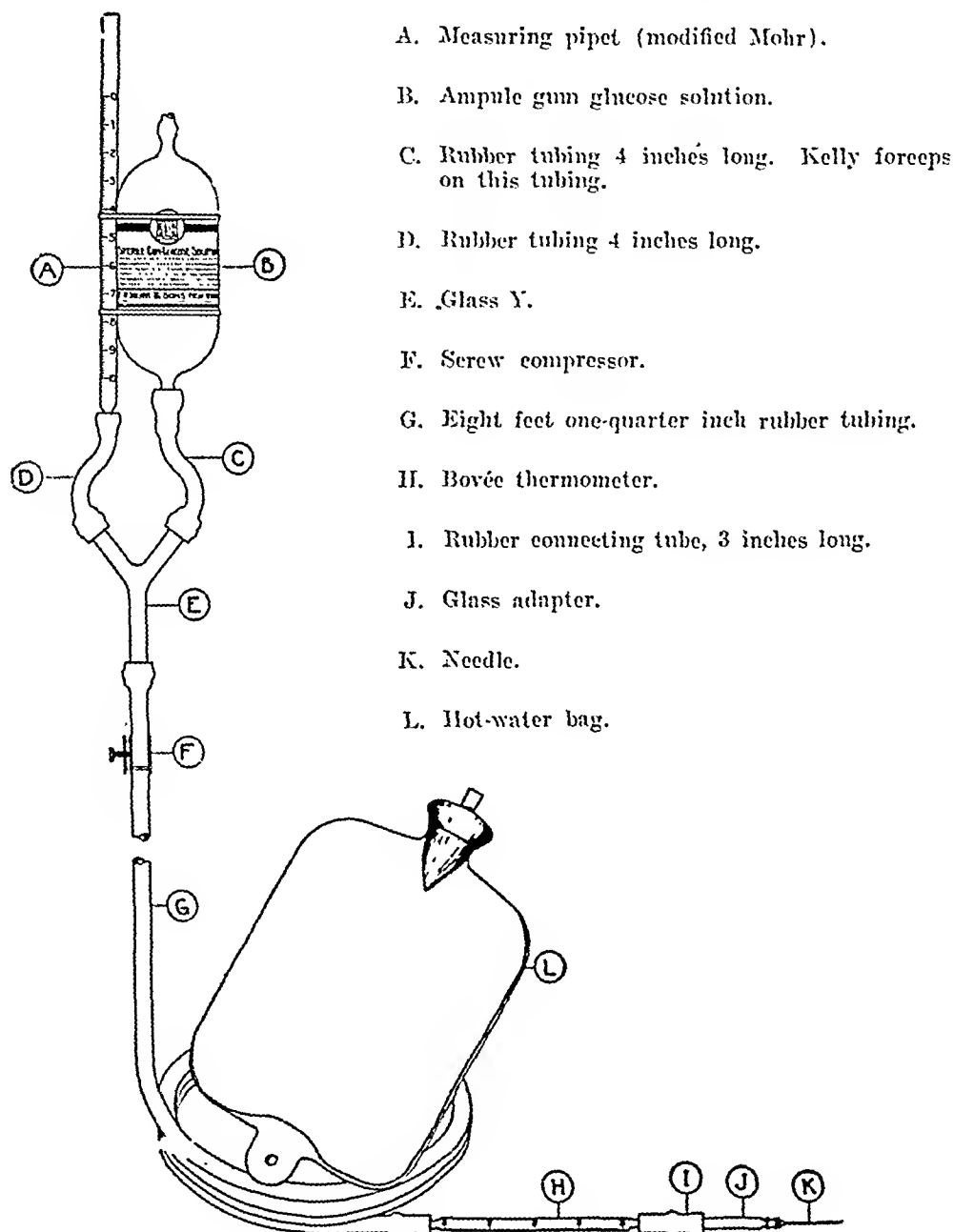


FIG. 320.—GUM ACACIA GLUCOSE SOLUTION APPARATUS.

ing off the body fluids. It is well, however, to increase the amount of gum glucose given to 10 c.c. per minute as the abdomen is about to be closed and for this time only; this acts as a stimulant to the kidneys, frequently enabling the patient to void after the operation, by reason of the increased amount of urine excreted.

A 20 per cent solution of glucose is used without the gum acacia (at the same rate of 4 to 5 c.c. per minute according to body weight) in the vomiting in pregnancy, and in peritonitis, for its food value. Five hundred c.c. is the

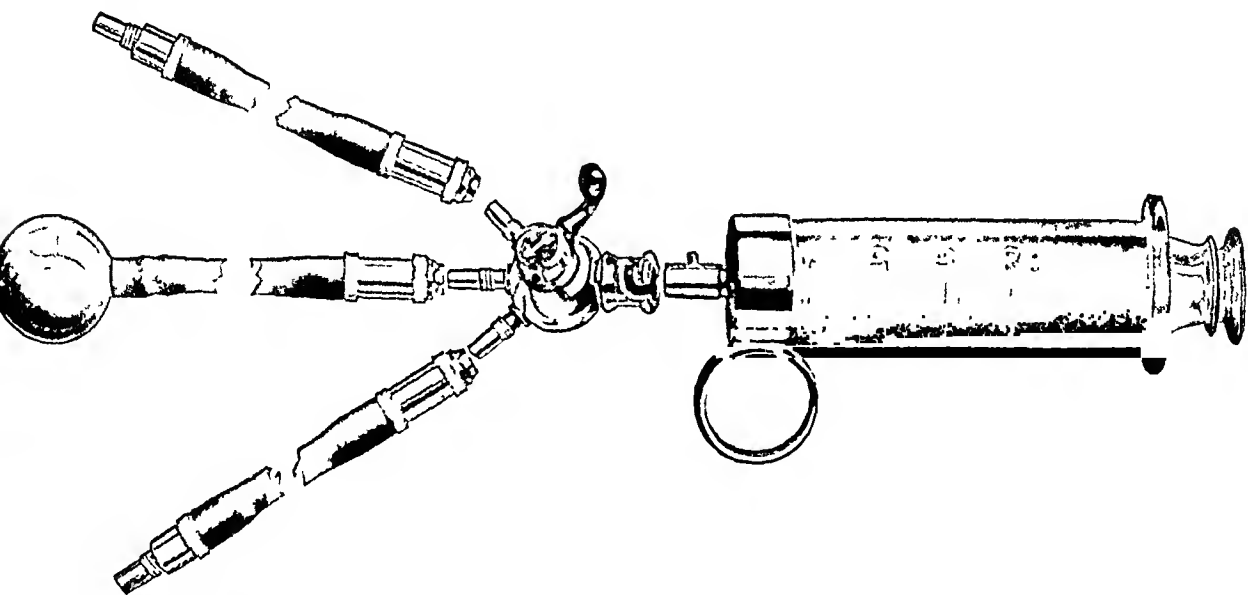


FIG. 321.—CLEANSABLE SYRINGE WITH THREE-WAY STOPCOCK USED IN ONE-MAN METHOD OF DIRECT TRANSFUSION.

usual amount given at one time, to be repeated once or twice in twenty-four hours until the patient takes nourishment orally. In postoperative suppression of urine, the rate of administration of the glucose solution, 20 per cent, is in-

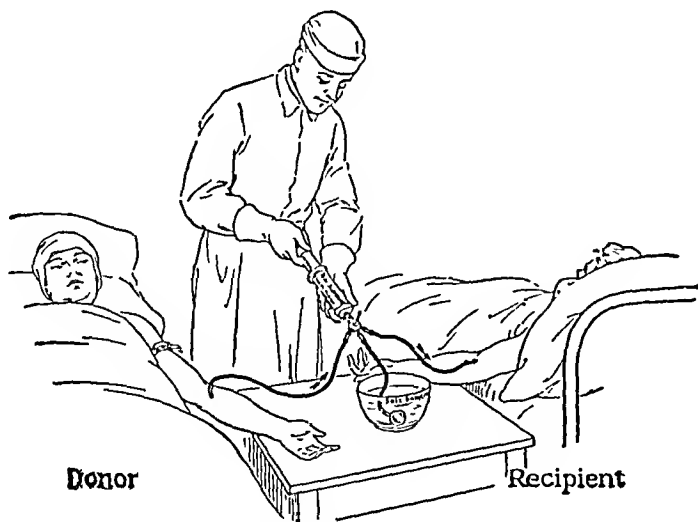


FIG. 322.—POSITION IN ONE-MAN METHOD OF DONOR AND RECIPIENT.

creased beyond the capacity of the liver for its diuretic effect. Five to six hundred c.c. of 20 per cent glucose solution given over a period of one hour is the usual amount. Fluid should then be given freely by mouth, rectum, or under the skin to offset the loss of body fluid.

If there is shock due to hemorrhage, the gum glucose solution maintains the circulation until a donor is typed and a transfusion given.

In the Woman's Hospital, blood transfusions are often given before operation to increase resistance as well as to replace the loss of blood in operation. Various transfusion methods have been tried out and although all of them have given satisfaction, all have been discarded in favor of a simple

one-man technique. We believe any procedure, however simple, is still fraught with so much danger if a mistake occurs that it is safer to use a syringe absolutely under the control of the one who gives the transfusion, which at the same time can be cleansed and recleansed at will without assistance and without disturbing either patient or donor.

W. W. Babcock, in an address upon "Resuscitation during Anesthesia," asked "How efficient a life-saving station have you in your operating room?"—a question every surgeon might well ask himself and then institute the drill Babcock recommends.

Should a patient during operation show evidence of collapse by failure of circulation and respiration, the anesthetist must report immediately to the surgeon the need of resuscitation.

When the surgeon gives the order to resuscitate, the following measures are carried out, with the object of maintaining:

1. Circulation
2. Respiration
3. Body heat

The circulation must be reëstablished within seven minutes.

Anesthetist:

Place patient in Trendelenburg position.

Hold jaw forward.

Place forceps on tongue and pull tongue out of mouth. (Rhythmic traction.)

Sponge mucus out of mouth.

Give oxygen.

Watch color, pupils, respiratory movements, pulse at wrist or temple.

Report at frequent intervals to the surgeon.

Report need for hypodermics of caffein sodium benzoate, 7.5 grains; camphor in oil, 2 grains; fedrin, 1 c.c. (for circulation); homocamin, 2 c.c., 10 per cent solution (for respiration).

Operator:

Order hypodermics.

Make rhythmic compression of chest.

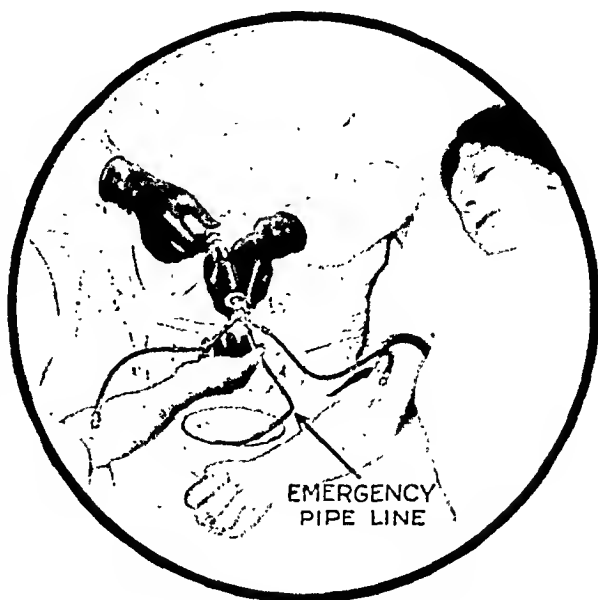


FIG. 323.—ONE-MAN METHOD SHOWING EMERGENCY PIPE LINE.

If abdomen is open, massage heart by rhythmic compression with one hand over left diaphragm and the other hand over the chest wall, at the rate of 30 compressions to the minute, as the intravenous solution is given.

Compress abdomen as second assistant blows into patient's mouth.

Give as a last resort a hypodermic of 5-20 minims of 1:1000 adrenalin solution into the heart muscle in the third intercostal space close to the sternum, with a long, fine needle attached to syringe.

Perform tracheotomy in marked obstruction of trachea from mucus.

First Assistant:

Give intravenously in arm 10 minims of 1:1000 adrenalin solution with 200 c.c. of saline solution at a temperature of 105° F., cutting down on vein if necessary. Watch radial pulse; stop solution the instant the pulse shows improvement; renew if pulse again shows failure.

Second Assistant:

If there is no response to rhythmic compression, extend the patient's arms over the head (Sylvester method if possible, 16 movements per minute).

Compress patient's nostrils; place gauze over mouth and blow at regular short intervals into the patient's mouth.

Third Assistant:

Stretch sphincter ani.

Act as general assistant.

Head Nurse:

Bring tray (kept sterilized and ready in each operating room) containing:

Sterile hypodermics filled with:

Caffein sodium benzoate, 7.5 grains.

Camphor in oil, 2 grains.

Fedrin, 1 c.c. (for circulation).

Homocamfin, 2 c.c., 10 per cent solution (for respiration).

Adrenalin solution, 20 minims. This hypodermic should have an extra long, fine needle attached.

Sterile funnel and tube with connecting tip, thermometer, and needle, all attached and ready for instant use.

Medicine dropper, scalpel, catgut, ligature carrier, needles, needle holder, scissors, thumb forceps, artery clamp, cotton balls, flask with 300 c.c. of saline.

Adrenalin solution, 1:1000.

Assistant Nurse:

Bring oxygen tank, blankets, hot-water bottles.

Give hypodermics when ordered.

Drainage.—A statement when to drain and when not to drain is tantamount to a declaration of the operator's personal faith.

In the eighties, in Lawson Tait's time, we drained whenever the abdomen was opened, fearful lest a little serum or blood might accumulate in the abdomen. This was justified by the utter uncertainty of the outcome due to the fact that there was no adequate hand disinfection.

The rule to-day is drain but rarely, some excellent operators say never, crying, "*Fort mit dem Drain*," as Werth of Kiel cried, shocked by the wound infections once, "*Fort mit dem Catgut*."

My own belief is that the drain is occasionally of extreme importance and definitely life-saving.

It is used in our abdominal work with one or more of several objects in view:

1. When the peritoneum has been seriously contaminated, as for example, in removing an acute abscess or in enucleating a carcinomatous cervix from above.
2. When it has not been possible to extirpate all of an infected focus, a part remaining adherent to the pelvic wall or floor or elsewhere.
3. Where a ragged bowel has been sutured and there is doubt about the sutures holding.
4. Where there is reason to expect a capillary hemorrhage from denuded areas.
5. To drain the peritoneum of an extensive effusion.
6. As a telltale in a possible postoperative hemorrhage.

The simplest drain is an iodoform gauze wick wrapped loosely in thin protective rubber, forming a cigarette 1 to 2 centimeters in diameter, introduced either from the floor of the pelvis into the vagina or from the lower angle of the incision down into the peritoneum, the vaginal drain always being preferable. A drain should always be peripheral and ought never to pass between loops of bowel.

When introduced to relieve the peritoneum of the burden of absorbing blood and serum, it is always sufficient to lay an abdominal wall drain just inside the cavity, trusting to the posture of the patient and the tension within to cause the fluid to find the drain and escape by capillary attraction.

The utility of such a drain is over within forty-eight hours, or when it ceases to function, as evidenced by the cessation of the flow. A little twisting facilitates the removal. A silkworm gut suture laid in the track of the drain and left loose is used to close the opening.

Glass tube drains are not satisfactory, as the pressure of the lower end sometimes causes a fistula.

When there is an infected focus in the pelvis, the tract must be kept open until it granulates up from the bottom; such a drain ought to have its exit vaginally.

There is no doubt at all but that a good drain for a day or two often obviates a stormy distressing convalescence.

A necessary precaution: Avoid choking the drain, either at its vaginal or its abdominal exit; a choked drain is worse than none at all.

The Fowler posture, Figure 324, after operation is sometimes invaluable in assisting the drainage admirably secured by a Gatch bed, Figure 325.

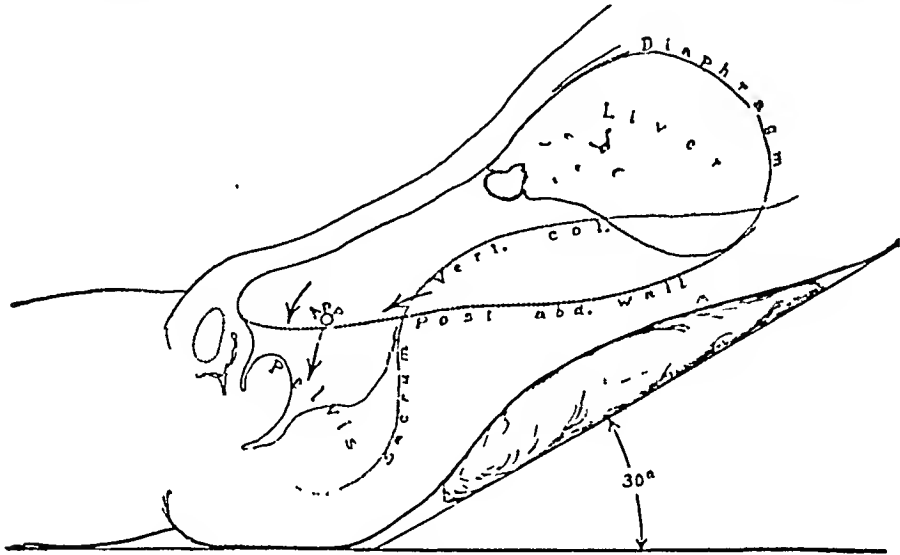


FIG. 324.—FOWLER'S METHOD OF DRAINAGE.

Thorax elevated to cause fluids to gravitate into pelvis instead of upward toward diaphragm.

Closure of Incision.—In closing, an incorrect apposition of the walls often causes a hernia of the linea alba. A fine linear scar should be an objective. The best method of closure brings into approximation layer by layer the three



FIG. 325.—GATCH FRAME. (W. D. Gatch.)

important layers—peritoneum, muscles and fascia, and skin. The speedy union of the divided peritoneum almost always prevents any skin infection from invading the abdominal cavity. In the deep fascia over the recti lies the chief source of strength against hernia, and by uniting this layer firmly the

muscles in their sheaths are held also and, therefore, as a rule, do not need separate suturing. If there is a thick fat layer, it should be united by a fine continuous catgut suture. Accurate apposition of the skin margins prevents contamination from without.

The first step in the closure is the union of the peritoneum by a continuous fine catgut suture. The next step is to lay from one to three figure eight silkworm gut sutures, embracing skin and fascia, about 5 centimeters apart. The purpose of this is to take the tension from the continuous suture which unites the fascial layer. The silkworm gut sutures are placed but not tied until all other sutures are in place. The next step is the union of the fascia by a continuous medium-sized chromic suture from end to end. A fine continuous silk or linen suture is used to bring the skin margins into accurate apposition. The skin sutures are cut in about seven days, and the silkworm gut, in from eight to ten days; the latter come out easier if removed the day after being cut. For closure of the skin, some prefer the Michel clamps as less likely to provoke any superficial suppuration.

Affections of Abdominal Incision.—The three troublesome affections of the abdominal incision are general or local infection of the wound, a hematoma developing under the skin, and a hernia developing at a later date in consequence of a weak spot left in the wall or formed after an infection.

Infection is usually signaled by an elevation of the temperature, by local pain, and by some hardness, or swelling with tenderness. If this occurs, it is best to open at once and drain it and dakinize the area. The old motto applies here, "A stitch in time saves nine"; early intervention may save the whole wound area. It is not wise to temporize with a small opening, but better to open the area wide enough to secure free continuous drainage and free access of the sterilizing solutions.

A hematoma forming a localized lump, sometimes discolored, in some part of the incision should be opened and drained to obviate suppuration later.

Hernia may be unavoidable in a bad suppurating wound with abdominal drainage.

Abdominal Dressing.—The best abdominal dressing is abundant fluffy sterile gauze on the wound held in place by broad adhesive straps across the abdomen. Such a dressing alone is often sufficient. A large abdomen is best supported by a well applied Scultetus bandage. Such a dressing should not be changed until the fifth to the seventh day if all is going well.

POSTOPERATIVE CARE

The after treatment is usually more or less routine. Certain minor disturbances, more or less closely simulating possible serious complications, may arise and assume importance for a time.

Abdominal operations are often attended by more or less depression, vary-

ing in intensity according to the vitality of the patient, the loss of blood, and the duration of the operation.

General Care.—While the operation is under way, the bed is well warmed. If hot-water bottles are used, I would never leave them in the bed with an unconscious patient, as I have seen serious burns from this cause: several ovariectomy patients with sloughs about the hips, and one with a bad burn on the heel crippling her for two years; in my very first ovariectomy for a huge tumor, the one drawback was an extensive, deep, hot-water bag burn on the right thigh. In one there was a leaky bag and the badly burned back required constant care for eleven months. Hospitals have repeatedly had to pay thousands of dollars for just such avoidable stupid accidents.

The room should be darkened and the patient kept in quietude in exclusive charge of her nurse who ought not to leave her alone; I have known women to get out of bed while only semiconscious, either to allay their thirst, or to find morphin. One of my earliest abdominal hysteromyomectomies, an old Irish woman, got out of bed and traversed two rooms and a brick pavement to a toilet in the yard. A mulatto girl with an extensive suppurative peritonitis persisted in getting up and lying on the floor as she had never slept in a bed. Both of these recovered.

The advantage of the bed, utilizing the convalescence as a rest cure, cannot be overestimated, sometimes making up the wear and tear of years of hard work and suffering.

It is best not to insist upon keeping the dorsal posture for days; on the contrary, the patient does better if she is turned on one side or the other soon after the effects of the anesthesia have passed. If she becomes bed weary after four or five days, she may be lifted in a sheet on to a cot, while the bed is shaken up, aired, and changed.

As to family and friends, the general rule is that the fewer the visitors the better and shorter the convalescence, but there are exceptions. Sometimes the worst visitor is the best loved nearest relative; on the other hand, such a person may be a bulwark throughout. Gossipy, meddling, officious friends who spend time criticizing the nursing must be kept out.

The need of a binder worn to prevent rupture is overestimated. I advise binders in fat women, or where the abdominal wall is lax; with most, however, it is a question of comfort.

The patient's personal care devolving upon the nurse is so important that I add a few directions.

When consciousness returns, hands and face are bathed in cool water and the mouth cleansed with a gauze sponge dipped in ice water. If there is a tendency to choke with mucus, the fauces must be wiped out with a clean napkin. When strong enough, a gargle of warm water relieves the thirst and the unpleasant taste of the anesthetic.

The head is best kept low, without a pillow at first, assisting breathing and

lessening nausea. A hair pillow under the flexed knees adds to comfort.

If tired and restless, a tepid sponge bath, followed by gentle rubbing and a cup of hot chicken broth or beef tea, may take the place of a narcotic.

If there is much pain, a hypodermic of $\frac{1}{8}$ or $\frac{1}{4}$ grain of morphin may be given when consciousness has fully returned, to be repeated if necessary during the first night. Milder sedatives are useless, but the morphin ought not to be continued over thirty-six to forty-eight hours; it should also be given with caution to a woman of a neurotic type.

Nausea.—Anesthesia nausea is variable and is most pronounced after ether and long operations. Nourishment should be withheld while it is active. A little cracked ice during the first twelve hours alleviates thirst and if the nausea persists, a warm nutrient rectal enema of a small cupful of peptonized milk and the yolks of two eggs, with salt, may be given every eight hours. A good adjuvant is an enema given with the first hypodermic—2 ounces of coffee and $\frac{1}{2}$ ounce of the infusion of digitalis, if the pulse is weak, with enough salt solution to make 8 ounces. Nausea is often relieved by teaspoonfuls of hot water, or a drop or two of tincture of capsicum in water, or a quarter of a drop of creosote in a teaspoonful of limewater. A mustard plaster over the pit of the stomach helps. Where there is much persistent nausea it is well to let the patient drink about 4 ounces of hot water so as to wash out her own stomach. The treatment of severe forms of vomiting is best carried out by washing out the stomach occasionally.

Food.—The first food given should be a teaspoonful of albumin in water or ginger ale, or hot weak tea, at half hour intervals, increasing the quantity as the stomach becomes tolerant. Strong coffee is also occasionally valuable as a stimulant. Milk is unsatisfactory as a rule on account of the acid stomach.

Egg albumin is a tasteless nutritious food, prepared by beating up the whites of four eggs into a liquid froth and allowing it to stand in a cool place for an hour or more, when about 50 c.c. of the liquid albumin is drained off for use. Another preparation is: Pour the white of an egg over half a glass of finely crushed ice, stirring gently, and adding a little sugar and lemon, made fresh every six to twelve hours, according to the time of year. Give a teaspoonful or two at a time, mixed in 2 or 3 tablespoonfuls of cold water, with a little additional sugar.

Additional articles of liquid diet are chicken broth, beef tea, and the various gruels. Hot oyster soup, with the oysters taken out, is an appetizing addition to the diet list. Whey and clam juice are good.

From 120 to 250 c.c. of nourishment will be taken in this way in the second twenty-four hours, increased to 300 to 400 c.c. in the third.

Thirst.—Thirst is sometimes consuming, and the patient in her desire to allay it scarcely knows what she is doing. I had a desperate ovariotomy case who reached down to her feet and pulled up a hot-water bag and drank a

quart of the warm water. A negress with a general gonorrhoeal peritonitis, with a drainage tube in her abdomen, got out of bed, walked into the hall, and drank a large quantity of water from the spigot of the cooler. Neither was apparently hurt by her experience.

The best way to treat thirst is to meet it as far as possible preventively by a rectal enema of one liter of normal saline solution while still on the operating table, elevated 6 or 8 inches. By comparing the charts of a hundred abdominal cases without enemata with a hundred in which they were administered, a remarkable alleviation of thirst as well as reduction in the vesical irritability was noted in the latter group.

Bladder.—For vesical irritability, give spirits of nitrous ether, 20 to 30 drops well diluted every two hours.

Two things are liable to give trouble, overdistention of the bladder and inability to empty it completely. Not infrequently great complaints of puzzling postoperative pelvic pains are due merely to a distended bladder, so easily relievable. Any persistent complaint should be investigated by a microscopic examination for pus and by catheterizing for residual urine.

A disastrous sequel is a more or less acute cystitis, sometimes persisting for weeks, due, as Arthur Curtis has shown, not so much to our too zealous catheterizations as to the fact that the patient in the disturbed condition of her pelvic organs and at the same time under the necessity of voiding lying on her back is prone to accumulate residual urine which soon stagnates and excites a violent inflammation. This complication is avoidable by catheterizing after she has evacuated in order to determine the quantity of residual urine. When this is found, she should be catheterized once or twice daily, and a weak solution of nitrate of silver (1:1,000) injected. It is thus clear that a postoperative cystitis is not due to catheterization but to the neglect of it. It is sometimes better to leave a mushroom catheter in the bladder for several days.

Bowels.—I believe surgeons are often overanxious to start the bowels moving. If the patient does well in other ways, it need cause no worry if the bowels seem sluggish and do not move even until as late as the fifth day. Often after a couple of days of feverish efforts, if the patient is let alone, they will act spontaneously.

As a routine, I give on the evening of the second day something that will operate by the following morning. Calomel is efficacious and as a rule well-borne by the patient, given in one dose of 2 or 3 grains, or $\frac{1}{4}$ to $\frac{1}{6}$ grain hourly for six hours, followed in the morning by citrate of magnesia. About two hours later, an enema of 100 c.c. of olive oil with 30 c.c. of glycerin should be slowly injected into the lower bowel. If this is not effective, wait four to six hours before making another attempt, consisting of a pint of water and soapsuds at a temperature of 110° F. with half an ounce of glycerin.

A saline enema used by C. P. Noble is:

R	Magnes. sulph.	5	ij
	Ol. terebinth	5	ss
	Glycerin.	5	j
	Aq.	5	iv
	q.s. ad		
Mix and inject into bowel.			

It is not advisable to use more than two enemata during the third day; it is better to assist the calomel by castor oil or magnesium sulphate in $\frac{1}{2}$ -ounce doses or by a pill of aloin, strychnin, and belladonna.

An alternative which is, I think, more satisfactory, is two aloes and mastic pills at night, about thirty-six hours after the operation, or 5 grains of cascara, followed in the morning with an enema of 4 ounces of oil, an ounce of glycerin, 2 drachms of turpentine, and enough soap and water to make a pint. After this let the patient alone until evening or even for twenty-four hours.

With the bowels once moved, they should be evacuated every other day.

Tympany, the cause of much distress, is usually quickly relieved by a free evacuation. Drop doses of tincture of capsicum or a few drops of tincture of nux vomica in a teaspoonful of hot pepper tea, are good adjuvants. A rectal enema of 90 c.c. of milk of asafetida is also effective.

Temperature.—The temperature in every convalescence needs most careful watching. On the second or third day it is not uncommonly elevated to 100° F. (or even 101° F.), usually dropping with the first free evacuation. This slight rise which appears to be due to absorption of a fibrin ferment, may exceptionally be prolonged for several days. A persistent temperature, however, above 100° F. is generally due to infection, either of the wound or in the peritoneum. A sudden rise in temperature, sometimes attended with chill, toward the end of the first week, often indicates suppuration in the incision. The wound should be inspected immediately for any hard, red, tender areas on one side or the other, the stitch or stitches at that point removed, and the lips of the incision slightly separated, to favor the discharge of pus. With the escape of pus, the temperature falls.

Pulse.—The pulse is likely to remain quickened by twenty or thirty beats for three or four days after any severe operation. If the general condition is good, and the pulse full and compressible, this need give no anxiety. The normal course is a steadily falling pulse; a rising pulse always calls for a careful investigation. In general a pulse from 120 to 130 beats needs watching; a pulse of 140 beats needs very close watching; a pulse of 150 beats needs anxious watching. Temperature and pulse should always be studied in association. If the pulse is high, from 120 to 140 beats, combined with a high temperature, after the first day, when the bowels have been freely moved, there is in all likelihood an infection. The most satisfactory sign of progress is a free evacuation of the bowels with a falling pulse and temperature.

Facial Expression.—Facial expression is significant and taken together with temperature and pulse is a good index of the general condition. A bright natural expression is to be looked for during the normal convalescence; a flushed, dusky, anxious, haggard, or a lack-luster look indicates trouble.

Sutures.—In from one to two weeks, usually, the patient gets out of bed, the day depending on the seriousness of the operation and her recruiting powers. Speaking generally, it is safer to get up earlier if the incision is a small one. I have tried getting my patients up in two or three days, but do not like it: the poor need the extra rest and care, and the well-to-do demand it. The best one can say is that it can be done without apparent added risk.

Recovery.—It is well to tell our patients that some of the original discomforts may persist for months and disappear by degrees; complete recovery to health often takes a year or a year and a half.

Fresh air, change of scene, rest, freedom from cares, good diet, regulated bowel function, and cheerful companions are invaluable aids in convalescence.

Most women need the supervision of the family doctor for some months after returning home. I often insist, as a most salutary prescription, on an hour's rest recumbent in a darkened room, after the midday meal.

POSTOPERATIVE COMPLICATIONS

Marked deviations from the normal comprise complications varying in gravity all the way from the simple functional and local disorders easily relieved to grave systemic manifestations which may be fatal.

Normal convalescence may be attended with certain minor discomforts, as a rule neither excessive nor prolonged, leaving the patient fairly comfortable by the third or fourth day. Sometimes, however, these discomforts persist or become exaggerated or pass over into a variety of other untoward phenomena.

Greater skill and acumen are often demanded in detecting these complications and in adopting prompt measures to overcome them than in doing a difficult operation; skilled surgical attention is, therefore, as important in convalescence as at an operation. It is unwise for the surgeon to operate and consign his patient wholly to other hands when it can be avoided. The operator's best assurance as to the patient's welfare after the operation lies in his knowledge of the conditions found and dealt with at the operation, backed by the satisfactory thorough inspection of the entire field before closing the incision.

Shock.²—In all abdominal operations, the prevention and treatment of shock demand special consideration. No matter how serious the condition, if shock is not already present, its development may be prevented by using conservative and restorative measures in advance of the emergency. This means the delay of any operative procedure, if possible, until the optimum condition is secured compatible with the disease, or, in an acute condition, the

² The section on shock is contributed by William E. Lower of Cleveland, Ohio.

performance only of operative measures necessary for the emergency, major procedures being postponed until the patient is restored to an optimum physical condition. In operating upon a bad risk, general inhalation anesthesia is to be avoided in favor of local anesthesia and nitrous oxid oxygen analgesia. Any extensive exposure of the viscera must be avoided as the most potent cause of a lowered body-temperature as a whole. To counteract the effects even of the unavoidable visceral exposure, a hot-water mattress on the operating table, hot packs, or diathermy, available throughout the operation, should be used. Water should be urged by every route, and to insure the most rapid hydration of the tissues, at least 3,000 c.c. should be given daily by hypodermoclysis, utilizing Bartlett's suggestion by adding sufficient novocain to make a $\frac{1}{32}$ per cent solution.

Transfusion of whole blood should be used without stint. Every hospital ought to have a number of donors with various blood-groupings ready for instant call, so that there need be no delay in applying this most useful and efficient method of restoration and conservation. The surgeon should also not content himself with a single transfusion if the patient is not doing well, but in suitable cases give transfusions before operating, at close of the operation, and even later.

Intravenous glucose solution, also, effectively combats shock (p. 404).

The protection of the myocardium is especially important; if impaired, one or more courses of digitalis will usually suffice to invigorate the heart action sufficiently for a safe operation. Rest and sleep must be aided by environmental control and suitable narcotics, except in jaundice, when narcotics, especially morphin, are contra-indicated.

An efficient restorative has recently been discovered in novasural, which removes edema in ascites, and relieves strain upon the heart and kidneys in a manner little short of marvelous.

An optimum temperature should be maintained by hot packs or better yet by diathermy after the operation as well as during the operation.

The value of morphin in peritonitis, present or impending, has been well-known ever since Alonzo Clark introduced the method of physiological dosage bearing his name. By assuring the utmost degree of physiologic rest, morphin is probably one of our most efficient aids in preventing shock in bad risk cases of any type.

When shock is actually present, like measures should be employed, for the fundamental principles for both the treatment and the prevention of shock are also based on fundamental demands of the organism; namely, abundant water, abundant oxygen secured by the maintenance of efficient circulation, restoration and maintenance of proper body-temperature, assurance of mental and physical rest and sleep, avoidance of surgical trauma or its reduction to a minimum.

If these basic rules are carried out, practically any operation anatomically possible can ultimately be performed. The surgeon must ever be guided strictly by the individual indications and should avoid any preconception as to the day and hour of the operation, that is, he should follow the lead offered by the patient's condition.

I have found that a hypodermic of atropin helps to prevent shock. Intravenous or intraeardiac injection of adrenalin is a heroic measure only used in desperate cases. Stimulating and nutritive enemata should be given on the table and later at intervals of from four to six hours. An excellent enema is: Twenty grains of ammonium carbonate, with sufficient water or beef tea, at a temperature of 100° F. to make an 8 ounce mixture, slowly injected. When reaction sets in, diminish the carbonate of ammonium and add yolks of two or more eggs.

In shock, while the stomach may tolerate a large amount of fluid, there is little or no absorption. Later, nourishment and stimulants should be given in small quantities, an ounce or two an hour. Gentle friction with alcohol helps when reaction sets in.

Shock from an exhausting hemorrhage is helped greatly by transfusion or by a salt solution under the skin.

Recovery from shock is indicated by the gradual rehabilitation of all the vital functions: the pulse increases in strength and becomes more regular, respirations are deeper, the temperature rises, the color improves, the expression becomes brighter, and the utter apathetic listlessness disappears. When in a few hours the general condition apparently improves further, and there is some vomiting and desire to change the position, the prognosis becomes yet more favorable.

Secondary Hemorrhage.—A frightful and fortunately rare sequel is a secondary hemorrhage. The pelvic organs are so richly supplied by large vascular channels that death can occur quickly if a ligature on a large artery slips. Such an occurrence is due to an error in the technique and is, therefore, more frequent in the hands of the inexperienced. In my early work, I met it as often as once in a hundred abdominal cases.

The chief causes are:

1. Defective tying
2. Cutting a ligature too short
3. Trimming the tissue too close to the ligature
4. Undue traction on the ligature after tying
5. Ligating surfaces which exert a pull in opposite directions
6. Shrinkage of tissues within the grasp of a ligature
7. Extensive capillary oozing

In placing a ligature, one must always allow for the strain of vomiting or coughing later on.

Pulse Peculiarities.—A convalescence is ideal when the pulse is but little quickened, the temperature only slightly elevated, the abdomen soft, and the recovery from nausea rapid.

Since the pulse and temperature constitute an excellent barometer of the patient's condition, deviations from the normal should be noted and watched. If the pulse is already quickened before the operation, ranging say from 100 to 130, some acceleration is to be expected. A rise of twenty to thirty beats after a long operation is to be expected, and this is apt to persist for some hours or even a couple of days and need cause no anxiety. One of the best signs of reaction is the gradual drop in pulse rate. There is cause for anxiety when the pulse, previously regular, quiet, and but little quickened, begins after twelve or more hours to rise to 120, 130, or 140 beats per minute. If in conjunction with this there is a rise of temperature and the patient assumes a distressed look, complains of pain, is nauseated and vomits occasionally, and the abdomen is tympanitic, septic infection may exist. It is, however, a mistake to consider even a very high pulse as indicating a fatal outcome. I have repeatedly seen patients recover whose pulse was as high as 140 or 150 for hours; in one instance it ranged between 150 and 162 for three days and was followed by an uninterrupted recovery.

I removed an ovarian cyst from a feeble old woman whose pulse went up to 210 during the operation, and one of my residents, by carefully counting the cardiac impulse over the pericardium, made it at one time 240 per minute, and yet she recovered nicely.

An intermittent pulse is fairly common after a rapid rate during operation. A markedly intermittent pulse in the latter stages of an infection is cause for grave apprehension.

Occasionally one meets a slow pulse, but usually it was also slow before operation.

Temperature.—Subnormal temperature is indicative of profound depression arising from shock, hemorrhage, or the gradual retrogression of the vital functions preceding death. The temperature may fall slightly below normal during or immediately after an operation from the refrigerant, depressing effect of the anesthetic, especially with ether, but quickly returns or rises even above the normal upon the application of external heat.

A sudden fall of temperature after recovery from the immediate effects of operation, associated with an increased pulse rate, is one of the signs of hemorrhage.

When malaria is prevalent, or a patient comes from a malarial region, a sudden rise of temperature calls for a blood examination, when anxiety may be relieved by finding the plasmodium.

Vomiting.—Nausea and vomiting often follow an ether administration. Vomiting is a complication when persistent or excessive.

The personal peculiarities and idiosyncrasies of an irritable stomach or a

tendency to excessive nausea are an important factor in the case and should be inquired into before the operation.

Vomiting may last from one to three days and exceptionally longer, as a rule quieting down if the stomach is let alone. In peritonitis the vomiting becomes more frequent and retching in character and the ejecta consist of a little yellow or black bile, expelled in small quantities. An excessive emesis associated with severe intermittent pains and a failing pulse, with slight elevation of temperature, points to intestinal obstruction when the vomited matter may soon become feculent. Occasionally the retching is due to one or more ascarides which are sooner or later ejected to the great relief of the host.

Give the stomach rest so long as it is irritable, maintaining nutrition by rectal alimentation. Internal medication is usually of little service, but lime-water occasionally allays excessive irritability. A few drops of the spirits of chloroform may be given at intervals; bismuth subnitrate and morphin in small doses are valuable; a drop or two of tincture of capsicum in a teaspoonful of hot water is of value. If the bowels have not been moved, prompt relief often follows evacuation.

Occasionally relief follows a stomach lavage with a weak boric acid solution, when after two or three washings the vomiting ceases. I resort to lavage when doubtful whether or not there may be an obscure peritonitis or ileus; several times it has seemed to save life. Its happy effect was illustrated in a patient from whom an enormous subperitoneal myoma was removed; all went well until the sixth day when she cried out with intense epigastric pains and vomited violently, apparently going into collapse. Although but an ignorant woman, she declared her bowels were closed and she must have a passage or die. I used gastric lavage with immediate relief.

A hot-water bag, ice-bag, or weak mustard plaster, applied to the epigastrium, usually adds to comfort and may insure relief.

Tympanites.—Excessive tympanites is a distressing sequel. The distended abdomen is sensitive and pressure on the stomach and diaphragm interferes with respiration and digestion. I have seen death due to paralysis of the diaphragm where an autopsy revealed no other discoverable cause. Palpitation of the heart and disturbed rhythm are frequent concomitants. Tympanites, like the variation in pulse rate and temperature, is, however, usually without serious significance, being due simply to intestinal atony or constipation and promptly relieved by some patience and appropriate measures.

A turpentine stupe to the abdomen is a well-tried mild remedy. The stupe is made by wringing out a broad piece of flannel in hot water containing turpentine, 60 c.c. to the liter; if left on too long or too frequently repeated, it blisters.

The introduction of a rectal tube into the lower bowel with a discharge of flatus often affords prompt relief. It may be well to leave the tube *in situ* for several hours.

Hoffman's anodyne, 20 minims to a drachm, given on cracked ice, is a good internal remedy; also 5 drops of turpentine in emulsion or on loaf sugar will stimulate peristalsis.

The evacuation of the bowel by an active purgative, such as magnesium sulphate, citrate of magnesia, or a pill of aloin, strychnin, and belladonna, followed by repeated enemata of oil or soapsuds, is the best means permanently to relieve tympany, to be used when milder measures fail.

An excellent remedy is an intramuscular injection of pituitrin, the nurse holding herself in readiness to give a glycerin (20 c.c.), turpentine (3:6 c.c.), soap, and water enema within fifteen minutes.

A good treatment for distressing tympany is lightly to brush the abdomen with a cantery, heated dull red and drawn quickly over the abdomen, hardly touching the epidermis. When the entire abdomen has been gridded in this way, the patient often expels the flatus in volumes; so great is the relief that I have known women, almost paralyzed with fear at the sight of the red hot tip, to request the treatment on a slight return of the trouble.

L. M. Sweetnam, of Toronto, in extreme cases heroically put his patient in a knee-chest posture and introduced a rectal tube, when as the tube passed up behind the uterus volumes of gas escaped. In like manner I relieved a woman desperately ill with a barrel-like abdomen which was as tense as a drum and with a pelvis so choked with ballooned intestines that the rectal tube was useless, by chloroforming her and introducing, in the knee-chest posture, one of my long rectal specula through a bowel collapsed up to the sigmoid flexure; gas escaped freely, and she recovered.

Excessive Pain and Sedatives.—Pain is often a question of temperament. Highly sensitive, nervous women will often complain excessively, while the more phlegmatic and those used to self-control, suppress any outcry and only complain if questioned. Pain is a variable factor, not depending upon the gravity of the operation, and cannot be predicted; it is undoubtedly less in those who are drained.

Unassociated with other untoward symptoms it calls for no alarm as it usually subsides in from twenty-four to forty-eight hours. Morphin addicts complain most bitterly and are slower reaching the quiescent period. If sedatives are withheld when pain is severe, this latter group becomes exhausted in one or two days and is less importunate, and it then becomes easier to break the drug habit by eliminating all anodynes in the convalescence. The moral effect of such a triumph over real pain, and the realization that it can be done without morphin, are of great value in restoring the moral stamina.

Ordinarily, I do not object to one or two hypodermics of morphin, enough to give relief in the first twenty-four hours, but no practice is more pernicious than the persistent use of a sedative whenever the patient clamors for it. The general tone of a patient who has stood the pain with but little anodyne is far

better at the end of a week. A good combination is to use say $\frac{1}{6}$ or $\frac{1}{8}$ grain of morphia with $\frac{1}{2}$ grain of codein.

If there is doubt as to peritonitis, one must not obscure symptoms by dopping.

Parotitis.—Inflammation of a salivary gland is a rare distressing sequel; from the third to the tenth day after operation, a swelling appears in front of the ear, gradually spreading until it involves the entire gland, sometimes associated with an edema of the side of the face and the neck. There is marked tenderness and pain grows constantly more severe and the fever rises as high as 105° , the jaw is stiff, and there is an extreme malaise with evident septic absorption. The parotid secretion is suppressed, or becomes purulent.

The infection clears up gradually in milder cases, or it runs its course to suppuration, or even, rarely, gangrene and death.

When the pus is not liberated by an incision, it sometimes bores into the external auditory canal and into the deep neck and postpharyngeal space, or even through the olivary foramen into the cranial cavity. By venous thrombosis the infection may spread into the cranial cavity or pyemia may result (Blair, *Surgery and Diseases of the Mouth and Jaws*, 1917).

The etiology has greatly puzzled clinicians; because it is generally a sequel to an abdominal operation, it has been ascribed to some mysterious selective relationship between abdominal and pelvic organs, such as appears in reversed order in the ovarian and testicular swellings complicating mumps. It is to be noted that it does not follow any special type of abdominal operation. There is further conjecture as to the avenue by which the infection enters the gland. A contributing factor is without doubt a foul mouth. It is my conviction that a postoperative parotitis is due to the thumbing of the parotid gland by the anesthetizer, who clamps his apparatus on to the face with his thumb and fingers, hooking his thumb behind the jaw and bruising the gland throughout a more or less prolonged operation. This contention seems sustained by the fact that with the types of anesthesia, which dispense with all jaw manipulations, this complication is practically unknown.

The treatment is first prophylactic; namely, to attend to oral asepsis beforehand, and to keep mouth and throat clear by a suction apparatus when secretions are troublesome, and above all to avoid all pressure upon the parotid gland, especially in taking the pulse at the temporal artery. The anesthetist should also avoid hooking up the jaw. With an infection developing, an ice-bag should be applied and morphin given to relieve the pain, and when the inflammation is intense and especially when a point of softening is felt, an incision should be made down to the capsule of the gland which is incised while further efforts to locate the pus are made by pushing a blunt-pointed forceps in one or more directions until the abscess is found. Free drainage is usually followed by immediate relief and recovery. In any extensive cutting operation, the great danger is injury to the facial nerve. Sometimes it

is well to incise freely down to the gland, to pack the wound, to wait a day or two for the localization of the suppuration, and then evacuate as described. J. A. Danna of New Orleans, by making a curved incision around the angle of the jaw, evacuated the pus and avoided an unseemly scar.

Pleurisy.—Pleurisy, comparatively rare after eeliotomy, occurs either independently or as a symptom of a septic infection; it is rarer than pneumonia. A tuberculous form may be associated with tuberculous peritonitis, with an insidious onset masked by the peritoneal symptoms.

Septic pleurisy is usually associated with mild grades of infection and appears four or five days after the onset of the septic symptoms with an abrupt rise in the temperature, a chill, and an accelerated pulse.

I have noted five pleurisies in over twelve hundred abdominal operations. Four were mild and readily passed off. The fifth followed a difficult operation for the removal of large cystic myomata weighing thirty-nine pounds and she did nicely after her operation, but while sitting by a window was seized with severe pain in the left side with a quickened pulse and a temperature of 102° F. and friction râles; a week later there was a relapse with effusion which quickly subsided, when complete recovery supervened.

The symptoms are usually characteristic: Difficult painful breathing on one side, a short hacking cough, diminished respiratory movements, and friction râles.

It is important to distinguish this carefully from a pulmonary embolus of moderate size which is commoner one or two weeks after operation and gives rise to a sudden severe pain with embarrassed respiration and cardiac action. Any marked local signs of pleurisy are wanting.

Pneumonia.—Postoperative pneumonia arises from exposure in the operation, or the irritating effects of an anesthetic, or the inhalation of foreign matter (inspiration pneumonia), or the lodgment in the pulmonary arteries of septic emboli from a focus at the seat of operation. It is often blameable upon a prolonged and unnecessarily free use of ether and is distinguished from the embolic form by its earlier onset, within the first twenty-four hours.

Nonseptic pneumonia occurred seven times in seventeen hundred cases.

The prognosis is favorable; the crisis is soon passed.

A septic embolic pneumonia may arise many days after the operation, and, if mild, may terminate as an ordinary pneumonia. It often appears also as a concomitant of a general septic infection, when it becomes a determining factor in the fatal issue.

In two pyemias disseminated patches of septic pneumonia were discovered at the autopsy, not found in the careful preliminary physical examination.

Ileus.—Ileus after operation results from an interference with intestinal peristalsis either by the strangulation of a knuckle of intestine under a band of adhesion or by an adhesion of the bowel to a raw surface or by adhesions of the bowels among themselves about a septic focus or by the incarceration

of a loop of the intestine through a hole in the omentum or, finally, by a simple rotation and twist of a loop on its axis.

The first sign is a griping pain more or less localized in one part of the abdomen, and occurring in paroxysms as often as every few minutes, beginning gradually and increasing to a maximum of intensity and subsiding. At the onset of the paroxysm, the expression is one of intense pain, followed by a cry as the acme is reached.

The peristaltic wave can be seen if the abdominal walls are thin; the distention is greatest above the obstruction. If the obstruction is but partial, fluids and flatus pass with gurgling, often audible at a distance. The tense muscular contraction of the peristaltic wave can be felt by the hand. Following the paroxysm the prostrated patient is bedewed with a cold sweat.

The most important symptom is the difficulty in moving the bowels and the failure of flatus to pass from the rectum. While one or two passages may be secured at the outset from the lower bowel, after this nothing follows, in spite of every effort, and purgatives only aggravate the vomiting.

The elevation of temperature is moderate and the pulse at first holds up well. Nausea and vomiting continue persistent and distressing from the beginning. The contents of the stomach are first ejected; later, as the vomiting is more frequent and violent, the ejecta consist of little mouthfuls of bile and mucus followed finally by a dark stereoraceous fluid, and at last by liquid fecal ejecta. The abdomen soon becomes swollen, tympanitic, and tender.

With the exhaustion towards the last the vomiting may cease, and the delusive calm is but the precursor of the collapse. Finally the extremities grow cold, the eyes look sunken and the face pinched, while the pulse becomes rapid and shotty.

If the ileus is not speedily relieved, death soon takes place either from exhaustion or from gangrene and peritonitis. Apart from a septic complication, the patient may hold out for many days, especially if the strangulation is incomplete or low down. A woman weakened before the operation succumbs soonest.

It is vitally important to make a correct diagnosis as early as possible, as upon this hinge the immediate remedial measures. Ileus must not be confused with an aggravated tympanites, often giving rise to similar symptoms; it may be for a time indistinguishable, when the abdomen is swollen and tender, and the bowels are slow to respond, and there is some persistent vomitus. Add to this picture the intestinal tormina common for a few days after operation, and the picture of an early ileus at times seems almost complete. In tympanites, however, the general pain is rarely so severely paroxysmal, the pulse is fairly normal, there is not the profound depression, and there is an absence of the grave facial expression with an ileus; finally, anxiety is relieved by a copious evacuation, when the abdomen becomes soft and the ten-

derness lessens. If the condition is fair it is safe to wait, and a few hours or a day will settle the matter by the expulsion of flatus.

The differentiation between ileus and peritonitis may be easy or difficult, especially since both conditions may be present at once. Ileus in an infection due to adhesions around a septic focus represents a conservative effort to localize the infection. The rise in temperature, the quickened pulse, and the localized tenderness are here the best evidences of the complication.

It is important not only to recognize an ileus but to determine its position. If the stoppage (unfortunately relatively uncommon) is in the rectum or sigmoid flexure, the distention will be more uniform, the retching less frequent, and the pain not so great. In the small intestine, the stoppage will be found on the border between the distended and the collapsed bowel, often easy of detection if the abdominal walls are thin. A partial obstruction presents less urgent symptoms.

In eighteen hundred cases, I reopened four times for ileus with two recoveries and two deaths. The successful results followed early diagnosis and operation.

Prophylaxis at the time of the operation is the keystone in treatment; it is for this reason that an ileus is far less likely to occur in skilled hands:

1. Knuckle adhesions must be freed.
2. Adhesions binding small intestines to the pelvic floor and walls must be freed.
3. Peritoneal bands must be severed.
4. Openings in the omentum must either be closed by suture or excised, or else the omentum must be tucked up above, noting before closing that no loop of bowel has slipped through any hole.
5. Denuded surfaces must, so far as feasible, be covered with peritoneum.
6. Distended intestines should never be lifted out to be replaced with difficulty.
7. A sound omentum must be interposed between intestines and abdominal incision.
8. Any loop of intestine twisted on its mesentery must be readjusted.
9. The posterior pelvis must be filled after an operation by adjusting the loops of rectum and sigmoid and excluding small intestines.
10. A drain must never lead in between the loops of the bowel.

Widespread adhesions of intestinal loops in their natural mutual relations ought not to be broken up unless the peristalsis has been obviously interfered with.

The treatment of a suspected ileus is directed toward securing a free movement of the bowels by a large dose of calomel by the mouth, or by high enemata of soap and water, with a drachm of turpentine to the pint, given hourly.

Turpentine stupes on the abdomen are valuable for the paroxysmal pains. If these measures fail and the patient is in good condition, it is best to wait a few hours and then try again. If the vomiting is not frequent and the patient retains and absorbs nourishment, it is sometimes well to wait and watch even as long as two or three days. If, on the other hand, the signs are persistent and urgent and there is an increase in pulse rate with paroxysmal pains and vomiting becoming suspiciously stercoraceous, the course is an immediate operation.

The operative alternatives are, in a case too bad to stand anesthesia or any prolonged operation, an ileostomy under local anesthesia exposing and suturing a loop of small bowel to the parietal peritoneum at a point as far from the stomach as possible. If the obstruction is near the cecum, a whole loop may be brought out on to the surface and opened in a few hours to be restored.

If the point of obstruction is obvious, it will be sufficient to release it and see the current flow on into the empty bowel beyond. A twist of the bowel may suffice simply to throw the loop back into its normal position.

If the adhesions are more or less general and there is great uncertainty as to the efficacy of separating any one group, it will be better to anastomose the distended bowel as low down as possible to the ascending colon.

Separation of adhesions between the intestines should be done with the greatest care, and, in case an unavoidable injury to the muscular coat occurs, it should be repaired with very fine silk or linen sutures in a straight round needle.

Phlebitis.—Phlebitis in the femoral vein occurs as a postoperative complication in a little less than 1 per cent. I have seen nine in twelve hundred operations; once one began in the left leg and crossed to the right. It commonly appears two or three weeks after operation.

It is to be anticipated when there is some persistent slight elevation of temperature associated with pain, more or less severe, in one side of the pelvis. Sometimes careful measurement of the thigh shows a definite enlargement of the to-be-affected side from one to three days before the more obvious signs of a femoral thrombosis.

Phlebitis is prevented by extreme care in keeping out all infection and by handling the structures to be left in the pelvis as little as possible. I once abruptly cut short a phlebitis epidemic by correcting an assistant who in a theatrical way hammered the common iliac veins each time he introduced a retractor.

The local treatment of an established phlebitis consists in keeping the limb elevated and in the application of cloths saturated with a warm solution of lead water and laudanum or in warm fomentations. A slight flannel pressure bandage helps relieve the pain. The Paquelin cautery lightly touched over the inflamed vein often relieves. Spontaneous recovery occurs in a month or two.

Embolism.—Pulmonary embolism stands in intimate relationship to thrombosis of the pelvic veins. Since Mahler's work in Leopold's clinic elucidated the clinical signs and the underlying pathological conditions of thrombosis and embolism following gynecological operations, many cases have been observed and studied postmortem, notably by Olshausen, Wyder, and Gessner (see C. Ruge's *Festschrift über tödtliche Lungenembolie*). The sequence is a thrombus in a pelvic or femoral vein, its dislodgment and escape upward with the current through the heart and into the pulmonary artery; if the embolus is small the attack is characterized by precordial distress, pain, and dyspnea, associated with a quickened pulse, and after one or more attacks the patient may recover. Lusk observed a case in which the lodgment of an embolus in the lung was immediately followed by the rapid diminution of the marked edema of the leg. With the escape of a larger embolus, the patient complains suddenly of severe pain in her side or under the shoulder-blade, suffocation and extreme precordial distress as she sits elevated in bed with a profoundly distressed expression, gasping for breath, with all the auxiliary respiratory muscles brought into play, while a cold, clammy sweat bedews the face; as she grows more cyanosed, the mind, at first clear, becomes clouded until the exitus occurs. On the other hand, she may die in a few minutes or seconds as in the following case:

The operation was for a papillomatous ovarian cyst with an extensive ascites. The enucleation was difficult, leaving some flat nodules scattered over the pelvic floor; she made a satisfactory recovery until the fourteenth day when she sat propped up in bed. To an assistant making the rounds that night, she said she felt unusually well. At twelve o'clock she awoke, complaining of a numbness in the left leg. The nurse, supposing it came from a cramped position in bed, helped her to turn and rubbed the leg vigorously for a few seconds! Suddenly with a sharp cry she complained of frightful roaring in the head and suffocation, while the pulse became weak and intermittent, the breathing spasmodic, and in a few seconds she was gone. Such is too often the dreadful dramatic end.

Aside from the clinical signs detailed, Mahler lays great stress upon a persistent frequency of the pulse out of all proportion to the slight elevation of temperature. With the attack, the precordial pain, and the dyspnea, there is usually a rise in temperature coincident with a jump in the pulse rate; the latter drops speedily while the pulse remains high, due, it would appear, to the increased resistance and the elevation of blood-pressure occasioned by the plugging of one of the larger circulatory channels in the lesser system.

There is no possible treatment for the severer cases, but for those which are characterized by a succession of milder attacks, perfect quiet with entire freedom from any exertion are important.

Wyder said he would no longer undertake any serious operation in the

presence of an edema with a high pulse rate or signs of thrombosis, provided the general condition sanctioned delay.

Under no circumstances should an edematous leg be massaged in the convalescence.

The occurrence of such a frightful accident, with a small percentage frequency even with the best care and even after so simple an operation as a ventrofixation, inculcates the lesson that the surgeon must never call any operation simple and perfectly free from risk. One whose vitality is depressed and who is anemic should be watched with especial solicitude. A history of attacks of thrombosis add to the risk of an operation.

All cases of local tenderness and elevation of temperature with a quickened pulse, with evidence of the formation of thrombi, should be guarded with especial care, kept longer in bed, and any active evacuation or straining rigorously guarded against.

The avoidance of an artificial anemia, produced by excessive loss of blood during an operation, and the use of transfusion must be considered as an important prophylactic measure.

With absolute rest, small doses of morphin should be given to quiet the circulation and relieve mental anxiety; digitalis is taboo.

Intestinal Hemorrhage.—I have known of three deaths from a hemorrhage from intestinal ulcer; one was in the practice of Thaddeus Reamy of Cincinnati, another was related to me by Bela-Walla of Budapest, and the third was in my own clinic after an operation for a large left streptococcus pyosalpinx. The latter operation was by Hunter Robb; the abscess ruptured in the enucleation, and the patient died four days later with an extensive intestinal hemorrhage and a septic peritonitis.

The autopsy revealed a round ulcer of the duodenum 18 millimeters in diameter, with an erosion of a small vein 1 millimeter in diameter, while the large and small intestines contained soft reddish coagula in immense quantities, estimated at about 2 liters.

CHAPTER XXIII

SACRAL ANESTHESIA

W. W. SCOTT

ANATOMY

Normal

Variant

SELECTION AND PREPARATION OF PATIENT

SOLUTION AND INSTRUMENTS

ADMINISTRATION

In 1900, Cathelin (*Les injections epidurales*, 1903) first produced caudal anesthesia in dogs by injecting cocain into the sacral canal. Following the introduction of the much less toxic drug, novocain, Stoeckel in 1909 successfully used sacral anesthesia in obstetrics. One year later, L  wen and Gros increased the intensity of the anesthesia by adding sodium bicarbonate to the novocain solution. Other contributions are from Labat (*Regional Anesthesia*, 1922), Lewis and Bartels ("Caudal Anesthesia in Genito-urinary Surgery," *Surg., Gynec., & Obst.*, 1916), Schlimpert, Goldenberg, Thompson ("An Anatomical and Experimental Study of Sacral Anesthesia," *Ann. Surg.*, 1917), Fretz, Brenner ("Sacral Anesthesia," *Ann. Surg.*, 1924), Meeker ("Instrumentarium for Local Anesthesia," *Ann. Surg.*, 1924), A. J. School, Jr., ("Sacral Anesthesia in Urology," *J. Urol.*, 1921), Lynch ("Sacral Anesthesia," *Am. J. Surg.*, 1918, *Anesthesia Suppl.*), Shaw, and others (D. R. Pickens, "One Hundred Cases of Anesthesia, with Commend.," *J. Tenn. Med. Ass.*, 1916; M. L. Harris, "Regional Anesthesia, or Nerve Blocking," *Tr. Am. Surg. Ass.*, 1917).

Anatomy.—*Normal.*—The laminae of the lowest sacral segment do not coalesce mesially, resulting in the absence of the fifth spinous process and the formation of the sacral hiatus at the lower extremity of the canal. Corresponding to the inferior articular processes of the last sacral vertebra are two little prominent tubercles known as the sacral cornua. The hiatus, usually like an inverted V, is defined by the cornua and the fourth spinous process which lies in midline and a little above the cornua, Figure 326. It is covered by the sacrococcygeal membrane, a thin layer of fibrous tissue stretching between sacrum and coccyx and bounded on each side by the sacrococcygeal ligaments.

The sacral canal, prismatic in shape, extends from the hiatus to the upper limit of the sacrum to join the spinal canal of which it is the continuation. This has two walls, an anterior and a posterior, the former resulting from the

fusion of the bodies of the vertebræ and the latter, from that of the vertebral laminae. Within the canal, swung in a bed of areolar tissue rich in blood supply, is the dural sac about which the intraspinal venous plexuses form a rich network, with its continuation—the filum terminale, Figure 327. Branching from the borders of the dural sac which completely surrounds the cauda equina are the sacral and coccygeal nerves. According to Thompson, the dural sac ends near the second sacral vertebra, and the average distance from the sacrococcygeal membrane to the termination of the sac is 5.8 centimeters.

Variant.—The introduction of the needle into the sacral hiatus is sometimes made difficult by the presence of anomalies and pathological changes.

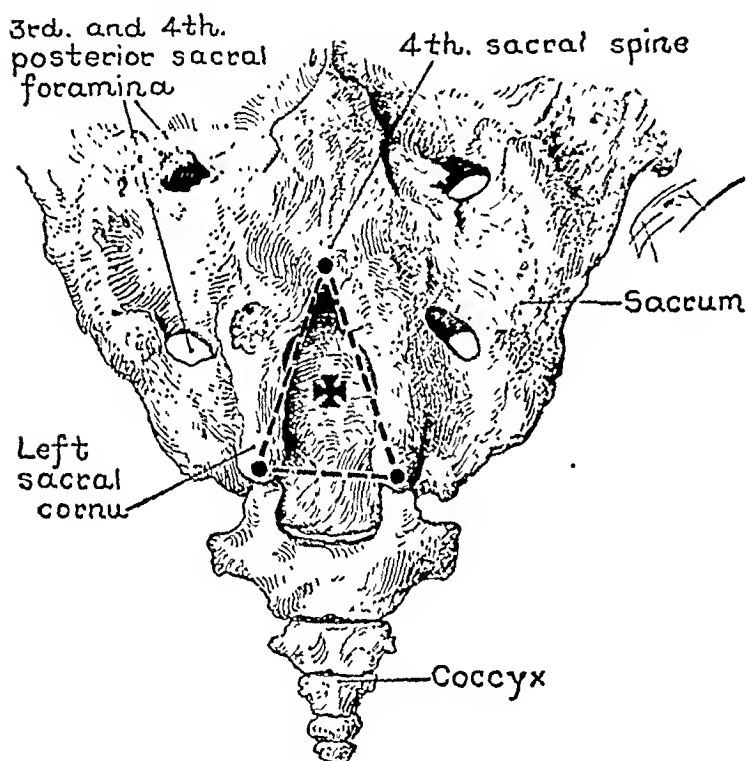


FIG. 326.—SITE OF PUNCTURE (CROSS) THROUGH SACRAL HIATUS IS CENTER OF TRIANGLE FORMED BY JOINING SACRAL CORNUA AND FOURTH SACRAL SPINOUS PROCESS. (Labat, *Regional Anesthesia*, W. B. Saunders Co.)

The following variations are the commonest found: curvature of the lower sacral bone segments with more pronounced angulation in the male than in the female; the amount of closure of the sacral arches; partial ossifications of the sacrococcygeal membrane; the number of sacral vertebræ; the protrusion of an intervertebral disk into the lumen of the canal; and the asymmetry of the sacrum due to traumatic or pathological lesions.

Selection and Preparation of Patient.—Not all patients are temperamentally fitted for sacral

anesthesia. It is unwise to use it on high-strung, excitable, apprehensive individuals, especially those who obstinately demand a general anesthetic after the advantages of caudal anesthesia have been explained to them. Where anomalies and pathological lesions of the sacrum are known to exist, general anesthesia is usually preferable. Patients with severe cardiac disease, especially with hypotension or angina pectoris, should be given a light ether rather than caudal anesthesia. In addition to the usual preparation for surgical operations, it is well to make certain that the patient has no idiosyncrasy to morphia by giving her $\frac{1}{4}$ grain on the evening previous to operation. If this test is negative, she should receive $\frac{1}{4}$ grain before going to the operating room.

SACRAL ANESTHESIA

Solution and Instruments.—A review of the literature shows a marked diversity of opinion concerning the amount and concentration of novocain or procain necessary to produce anesthesia in pelvic and perineal operations. Labat advocates 30 to 40 c.c. of 2 per cent novocain. Scholl uses 30 c.c. of a

2 per cent solution to which sodium bicarbonate and sodium chlorid have been added to accentuate the effect. In the Brady Urological Clinic, 20 c.c. of a 3 per cent solution of procain has been found to give better anesthesia with less tendency toward reactions than larger amounts of less concentrated solutions. The Labat 10 c.c. syringe with the bayonet-lock hub and the semiflexible nickel-plated needles are splendid for the introduction. Recently Sharp and Smith have produced a satisfactory type of syringe and needle.

Administration.

In the Brady Urological Institute the method of introducing the needle into the canal so admirably described by Labat is followed.

The patient is placed on the Young operating table in a ventral horizontal position and the sacrum raised and flexed dorsally on the lumbar vertebrae by means of a perineal elevator. Quite a satisfactory position, however, is secured with the patient flat on her abdomen, the sacrum elevated with sandbags. After disinfecting the skin, the fourth spinous process and the sacral cornua defining the hiatus are located. Then

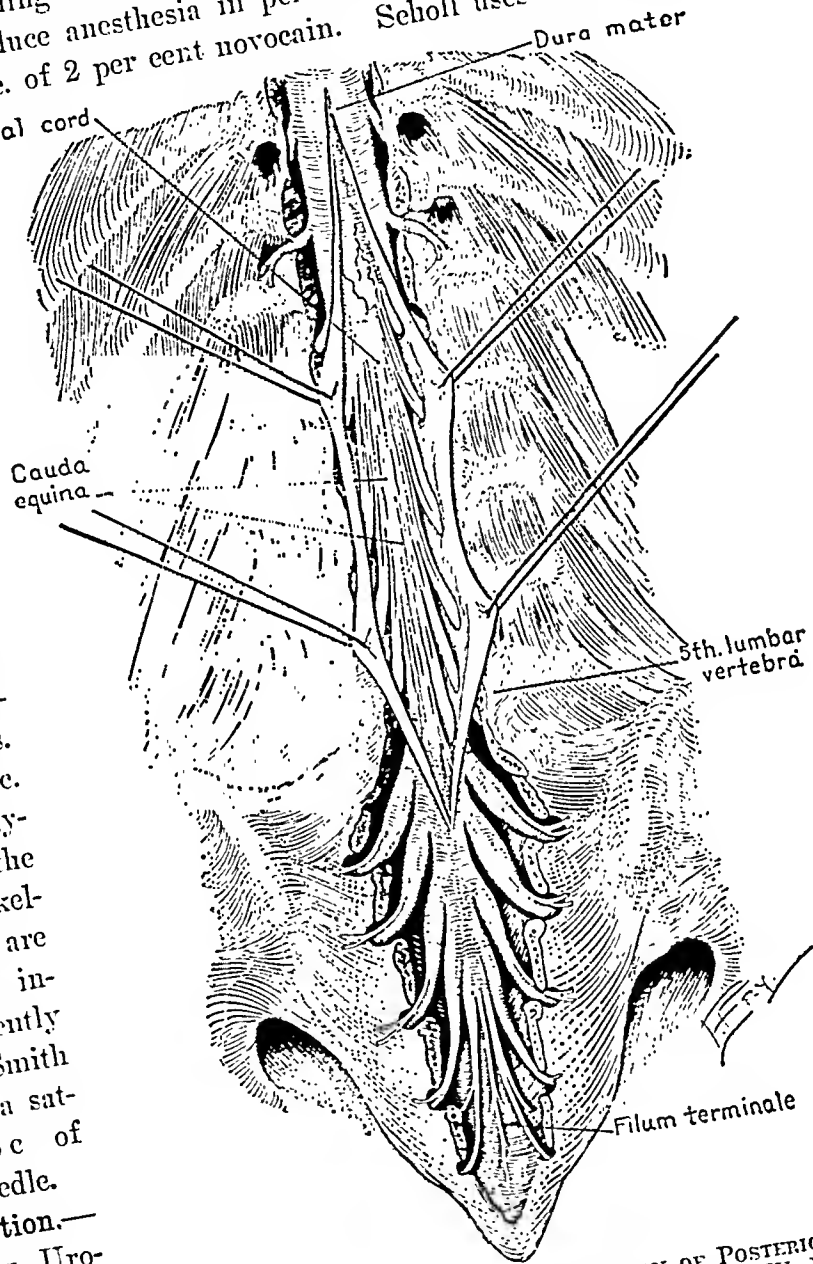


FIG. 327.—SACRAL NERVES AFTER RESECTION OF POSTERIOR WALL OF SACRAL CANAL. (Labat, *Regional Anesthesia*, W. B. Saunders Co.)

using a 2 centimeter hypodermic needle, the skin over the hiatus and the sacrococcygeal membrane are anesthetized. When the wheal raised by this has been massaged away, the tip of the index finger is placed so that the apex of the hiatus and the edge of the lumen or the corinna can be felt. A 10 centimeter Labat needle is now thrust in beneath the tip of the finger at an angle of about 45 degrees with the skin surface, pierces the sacrococcygeal membrane, and continues on until it strikes the anterior wall of the canal when it is withdrawn 2 millimeters and the hub dropped downward toward the gluteal

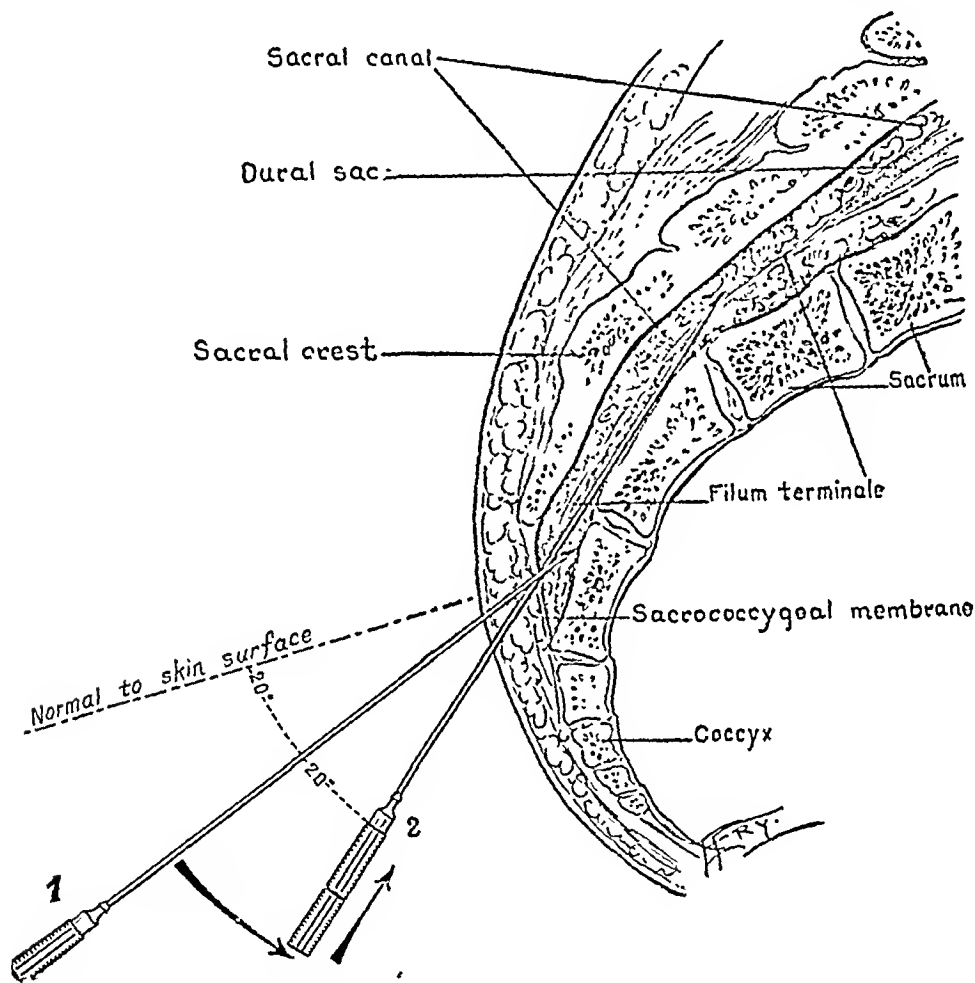


FIG. 328.—SACRAL BLOCK.

After piercing sacrococcygeal membrane, needle impinges on anterior wall of sacral canal and passes from position 1 to position 2 in direction of the arrows. (Labat, *Regional Anesthesia*, W. B. Saunders Co.)

clef, reducing the angle with the skin surface from 45 to about 20 degrees. It is then carefully thrust on up into the sacral canal, avoiding contact with its posterior or anterior wall by increasing or decreasing the pressure exerted by the finger previously placed at the apex of the hiatus, Figure 328. In fat patients with obscure landmarks, one depends entirely upon tactile sensation derived from the point of the needle as it pierces the sacrococcygeal membrane and comes in contact with the anterior wall.

The needle is passed about 5 centimeters into the canal, a syringe attached,

and the aspiration test performed to make certain that a blood-vessel or the dura has not been penetrated. If blood is aspirated, the needle is withdrawn about 1 centimeter and the aspiration repeated before the solution is injected. If spinal fluid appears, the injection should not be given. Under these safeguards, the solution is slowly forced up into the canal, taking six minutes to inject the first 10 c.c. The blood-pressure and pulse are taken every two minutes as the injection progresses and every five minutes thereafter to the completion of the operation. If the blood-pressure drops more than twenty points, 5 minims of an adrenalin solution should be injected into the deltoid muscle and no more solution forced into the canal until the pressure approaches normal. In the course of ten minutes, 20 c.c. of a 3 per cent solution of procain can be injected with little or no discomfort to the patient.

If force is necessary for the injection of the solution, the needle should be readjusted as the point might be beneath the periosteum or the entire needle might lie outside the canal. In the latter case, edema on the posterior aspect of the sacrum is usually observable.

Unfavorable reactions characterized by an increase in restlessness, disturbed pulse rate and blood-pressure, dyspnea, or, occasionally, coma and convulsions are attributable to procain intoxication following too rapid absorption into the blood stream. By carefully adhering to the aspiration test and slow administration of the solution, this sort of reaction is practically avoidable. There is another type of reaction characterized by a sense of weakness, with a drop in blood-pressure and a decrease in pulse rate and occasional nausea and vomiting, which is probably due to paralysis of the sympathetic nerves and more apt to occur following the injection of large amounts of solution, resulting in a high diffusion up the vertebral canal. Adrenalin, caffeine, and intravenous glucose are often of great value in combating these last-mentioned sequelae.

The area anesthetized varies with the amount of solution injected. The anesthesia involves the perineum, the inner and upper aspect of the thighs, the posterior surface of the scrotum, bladder, ischio-rectal fossae, urinary sphincters, vulva, vagina, cervix, and the posterior aspect of the sacrum with a portion of the buttocks. Failure to secure anesthesia occurs in 10 to 15 per cent of the reported instances. In a group of 250 in the Brady Urological Institute, failure occurred in 15 per cent, due, for the most part, to faulty technique in the introduction of the needle or to the presence of anomalies. Because of the ease and relative safety with which it can be administered, the freedom from the discomforts and complications so common after general anesthesia, and the marked relaxation obtained, sacral anesthesia is of extreme value in genito-urinary, rectal, and perineal surgery and is worthy of much wider use than it has at present.

CHAPTER XXIV

ABDOMINAL HYSTERECTOMY

HOWARD A. KELLY

INDICATIONS FOR OPERATION

METHODS OF HYSTERECTOMY

Extirpation by Continuous Incision from Side to Side

Sagittal Bisection

Horizontal Bisection

DRAINAGE

CLOSURE

Indications for Operation.—The removal of the uterus with diseased ovaries and tubes by the abdominal route is advisable when:

1. Efforts at conservation have failed.
2. The uterus is involved in inflammatory products or buried under masses of adhesions or beneath a bladder and rectum adherent over the fundus, as in some gonorrheal and tuberculous cases.
3. In addition to the extensive lateral disease, the uterus is subinvolved or there is a chronic metritis.
4. Incurable disease of the tubes and ovaries is complicated by a uterus containing myomata.
5. The enucleation *en masse* is technically easier and therefore safer than the removal of the lateral structures alone.
6. There is cancer of the body of the uterus.
7. Both ovaries are the seat of papillary, dermoid, or multilocular cysts.

When tubes and ovaries are excised, it is wise to remove the uterus also, since it is then useless and a source of danger, especially in women over forty. It is easier to remove the uterus with its adnexa than adherent tubes and ovaries alone. The complete extirpation affords a better view of the entire pelvis; ligation of the uterine artery gives better control of hemorrhage; raw areas are more easily covered; the operation is shorter; and better drainage is secured, if called for.

For these important reasons, hysterosalpingo-oöphorectomy is preferable to double salpingo-oöphorectomy.

I would make an exception only when the patient emphatically requests the retention of the uterus, while insisting that hands must not be tied but some liberty of judgment be left the operator.

The abdominal is the better avenue, as it offers a chance to inspect the structures lateral to the uterus and to elect a conservative course or the reverse; the entire operation is thereby done under perfect supervision and with the exposure of the entire pelvis; complications affecting the intestines are handled in the open; affections of the vermiform appendix are recognized and dealt with; ligatures throughout are applied with security and hemorrhage seen and easily controlled; ureters and bladder are less liable to injury.

Methods of Hysterectomy.—There are in general three methods of extirpation by the abdomen: (1) In the classical operation, the tubes and ovaries

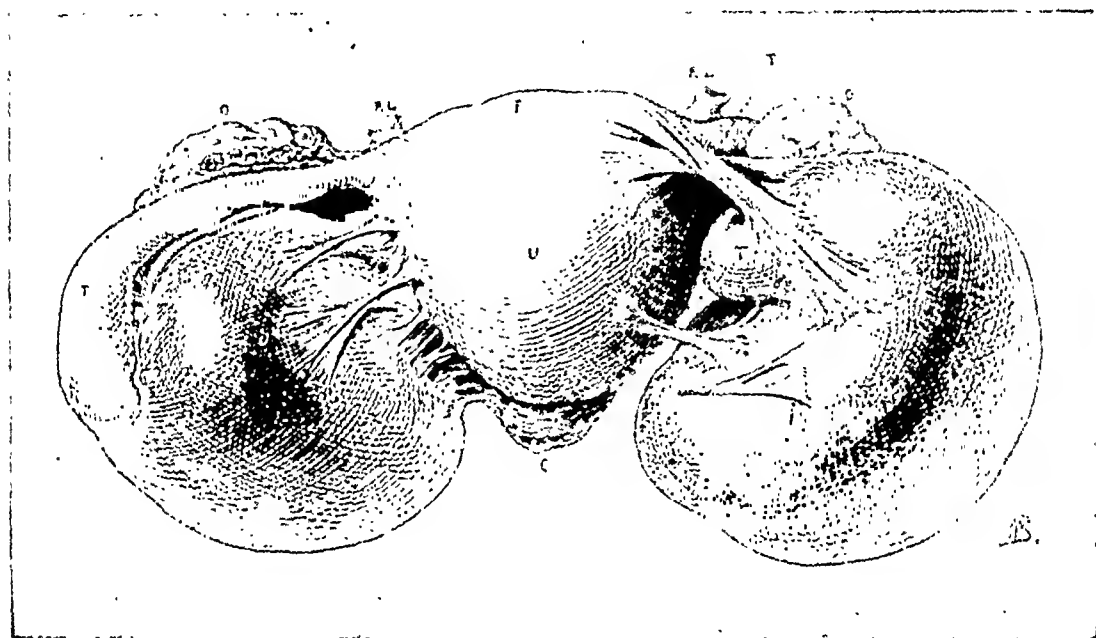


FIG. 329.—HYSTEROSALPINGO-OÖPHORECTOMY FOR LARGE DOUBLE HYDROSALPINX WITH EXTENSIVE ADHESIONS.

U, uterus; F, fundus; RL, round ligaments; T, uterine tubes; O, ovaries. $\times \frac{5}{8}$.

are tied off, beginning with the infundibulopelvic ligament of one side and then the round ligament, then tying off the opposite side and pushing down the bladder, and, finally, ligating both uterine arteries and amputating the uterus in the cervix supravaginally or removing the cervix as well. (2) Another method is starting on the easier less adherent side and cutting and tying down to the cervix where the uterine artery is exposed and ligated; next, cutting across the cervix and controlling the opposite uterine; then, carrying the dissection from this point upward, controlling the round ligament; and, finally, ligating the ovarian vessels opposite the starting point. This is an admirable, rapid, neat procedure, in every way excelling its classical predecessor. (3) An exceedingly valuable recourse in selected cases is first of all to grasp the uterus with museau forceps at both cornua and to bisect it well down into its cervical portion and then to amputate one-half of the cervix and control the uterine artery and on up the broad ligament to the round ligament and

the ovarian vessels, when one-half the uterus with its attached tube and ovary is removed; the next step removes the remaining half in the same way.

The last two methods are modified by carrying the dissection down to the vaginal vault so as to include the entire cervix, making the operation a panoöphorosalphingohysterectomy.

Extirpation by Continuous Incision from Side to Side.—An incision is made in the linea alba from 15 to 20 centimeters long, from the umbilicus or

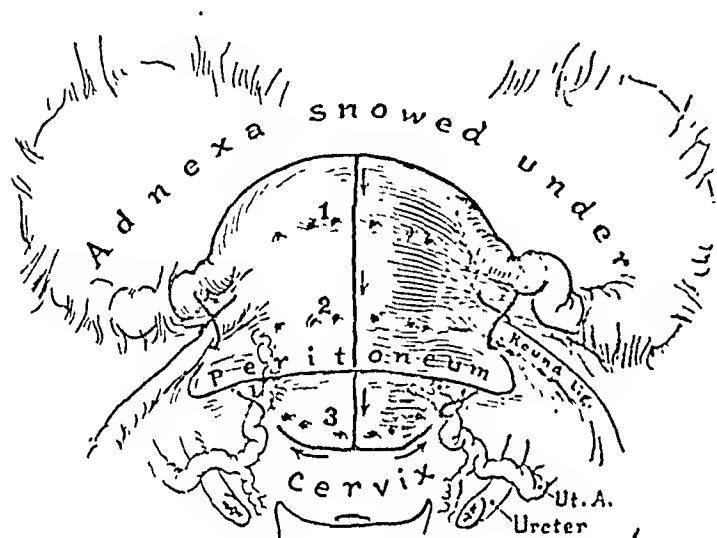


FIG. 330.—DIAGRAM OF SEVERAL STEPS IN HYSTERECTOMY BY BISECTION.

Uterus caught first on right and left sides with stout forceps at 1 and divided down below 2, then caught with same forceps at 2 and divided down into cervical region. Amputated in cervix on one side and caught underneath horizontal cut at 3 and one half enucleated, following direction of ligatures on uterine artery and round ligament. Opposite half enucleated in like manner.

pelvic walls are severed, using forceps and acusector or scissors, and the uterus with its ovaries and tubes is freed. Beginning, say on the left side, the steps of the extirpation are:

1. Left ovarian vessels ligated and severed out toward the pelvic brim.
2. Left round ligament ligated and severed a short distance from the uterus.

3. Vesico-uterine peritoneum freed from left to right round ligament and pushed well down with the bladder until the left uterine artery is exposed.

4. Left uterine artery and veins tied low in the cervical portion either close to or a little out from the uterus. A deeper detachment of the bladder exposes the vaginal vault for a panhysterectomy.

5. Uterus amputated low down in its cervical portion, exposing the uterine vessels on the right side.

6. Right uterine vessels clamped or tied well above the level of amputation.

from a lower point downward. The intestines fall out of the way with due elevation of the pelvis in a Trendelenburg posture. The small intestines and any redundant sigmoid are packed away up in the abdomen with a moist gauze roll. The pelvis thus fully exposed is carefully inspected and the extent of the operation and its important steps planned as a general plans his campaign after learning the location and disposition of the troops of the enemy.

The adhesions of the pelvic organs to bowels and

7. Uterus grasped by its cervical end and drawn up and out; right round ligament ligated and cut.

8. Right ovarian vessels ligated and cut and the entire mass—uterus, tubes, and ovaries—removed.

9. Clamps now replaced by ligatures.

10. Cervical stump closed with round ligaments implanted in the angles to hold cervix well up.

11. Anterior layers of both broad ligaments and vesical peritoneum drawn well over the stump and sutured, leaving a smooth peritoneal surface.

In panhysterectomy it will be wise to leave in a little central vaginal drain until the operator is sure of his technique.

The pelvic floor so reconstructed is analogous to the male floor, with no organs intervening between bladder and rectum.

The force of the push in liberating the bladder must fall upon the uterus and not on the bladder!

The whole cervix should invariably be removed with the uterus when it is in any way diseased—lacerated, infiltrated, cystic, discharging. A normal cervix not lacerated, infiltrated, thickened, and everted may be left, but it is well to amputate it low. In amputating the cervix, I have for many years practiced cupping it out, removing some or all of its mucous lining (“excochleation”), so as to form anterior and posterior lips. It is safer to complete the amputation on the opposite side at a higher level or to cut almost across and then cut up 1 or 2 centimeters, leaving a little sliver of uterine tissue attached to the cervical stump which I call a “snipe,” in violation of the principles of a woodsman who first notches his tree on the far side to avoid this very thing.

When the cervix is amputated, the uterus is grasped by its cervical end, drawn strongly upward, completely inverted, and the tissues kept under tension, separating the divided cervical ends by 2 or 3 centimeters and nicely exposing the uterine vessels. The uterine cavity must be prevented from emptying any contents over the wound by a clamp or by laying a thick piece of gauze under the canal and clamping it there.

A signal advantage of this method is the ease with which the emucleation can be effected by attacking adherent masses from below instead of from above; as for example, in a modification, when the uterus alone is removed first, leaving one or both adherent lateral structures to be dealt with individually and removing, as it were, the keystone of the arch and securing greatly increased facilities for the further emucleations with abundant room and easy accessibility, as well as the valuable opportunity of getting at and releasing the structures from the pelvic floor upward. It is often astonishing how easy it is in this way to roll a difficult adherent mass up and out of the abdominal

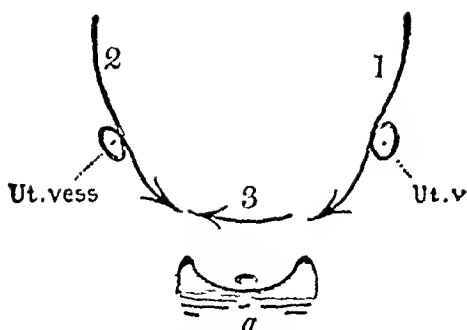


FIG. 331-A.—USUAL DIRECTION OF INCISIONS IN CLASSICAL OPERATION FOR REMOVAL OF UTERUS.

First, broad ligaments are tied off, as indicated by arrows 1 and 2; by this means ovarian vessels and uterine arteries are controlled. Then cervix is amputated as indicated by arrow 3.

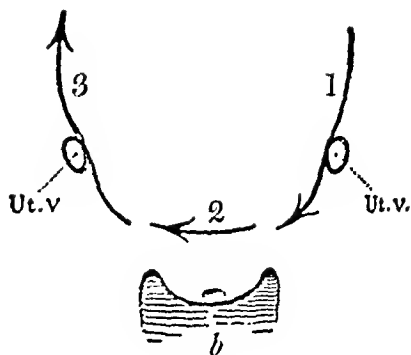


FIG. 331-B.—AMPUTATION OF UTERUS BY CONTINUOUS TRANSVERSE INCISION.

First, one side (the easier) is tied off, and uterine vessels controlled, following arrow 1. Cervix then amputated, following arrow 2; opposite broad ligament, with uterine vessels, controlled as indicated in a direction from below upward, following arrow 3.

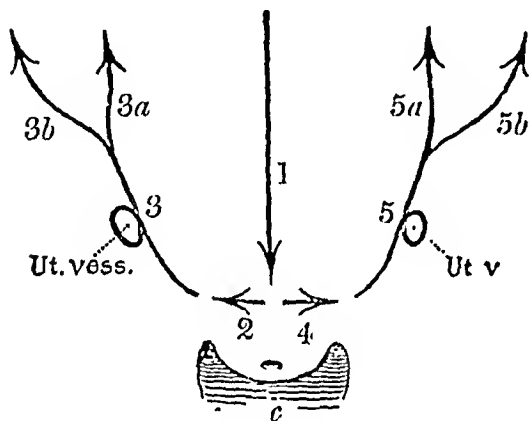


FIG. 331-C.—VERTICAL BISECTION.

Following arrow 1, uterus is split from fundus well down into cervical portion. Following arrow 2, one-half of uterus is amputated in cervical portion. Next, taking directions indicated by arrow 3, uterine vessels of side under process of removal are controlled; at this point there is an election of one of two alternatives, operator may either follow 3a, leaving tube and ovary in pelvis to be dealt with after extirpation of uterus, or he may take direction of 3b, electing to remove tube and ovary at once simultaneously with half of uterus to which they belong. Next, amputate remaining half of uterus in cervical portion, following arrow at 4, then take direction of arrow 5 to remove remaining half of uterus, again electing either to take direction 5a, leaving in tube and ovary, or to enucleate tube and ovary, with uterus following arrow at 5b.

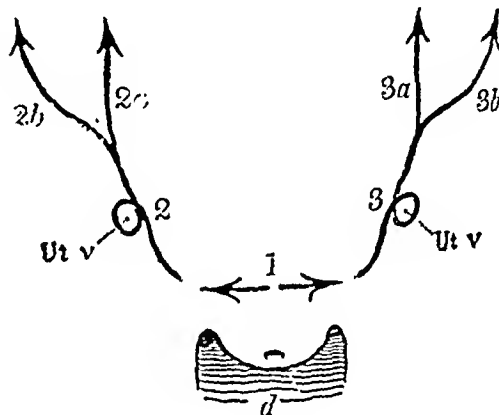


FIG. 331-D.—HORIZONTAL BISECTION OF UTERUS IN CERVICAL PORTION.

First, bisect uterus in cervical portion as indicated by arrow 1. Then enucleate uterus from below upward, following arrows 2 and 3, leaving *in situ* both or one of the tubes and ovaries, and taking directions through 2a and 3a, or removing these structures with uterus, following directions 2b and 3b. This procedure can be modified in cases of necessity by first dividing cervix horizontally and then bisecting uterus from below upward, after which each half is dealt with separately.

incision. It is usually best to empty a large abscess with an aspirator before freeing it, both to protect the peritoneum and to get more room in dealing with it.

As the uterus and its attached organs are removed, the cervical stump, or the anterior vaginal wall, is held up by a tenaculum forceps.

Sagittal Bisection.—Where both adnexa are extensively involved, a sagittal bisection is a more rapid and better procedure. The object is to secure the better approach to both lateral structures below and in the cervical region, either before or after removing the halves of the uterine body. The following objectives are realized:

1. Both uterine vessels are exposed and controlled first of all, preventing any serious hemorrhage.

2. Abundant room is created for attacking both diseased uterine tubes and ovaries.

3. A good light is poured into all parts of the field when the uterine mass is removed from the crowded pelvis.

4. New avenues of approach are secured from the front and beneath on both sides, always assisting the attack on the lateral diseased masses.

5. When the lateral masses are densely adherent, under these new conditions, they can with safety even be removed with scissors or scalpel and forceps, piece by piece, or destroyed thoroughly *in situ* with electrocoagulation.

Bisection offers the best guarantee against injury to contiguous structures, such as rectum, ureters, or great vessels, and is a rapid method of enucleation, at times of the utmost importance.

The surgeon will find it convenient, although not indispensable, to have at hand three pairs of strong museau forceps with stout teeth, curved near the end. Figure 332.

The exposed fundus, Figure 333, is grasped with a forceps at each cornu and pulled strongly upward. The body is completely divided in the median line and step by step down to, or a little below the peritoneal reflection. As the uterus is divided, lifted up, and the halves drawn apart, the third forceps is used to take a fresh grasp of the uterine tissues, across the cut surface, on one side about the middle. This releases the forceps at the fundus on that

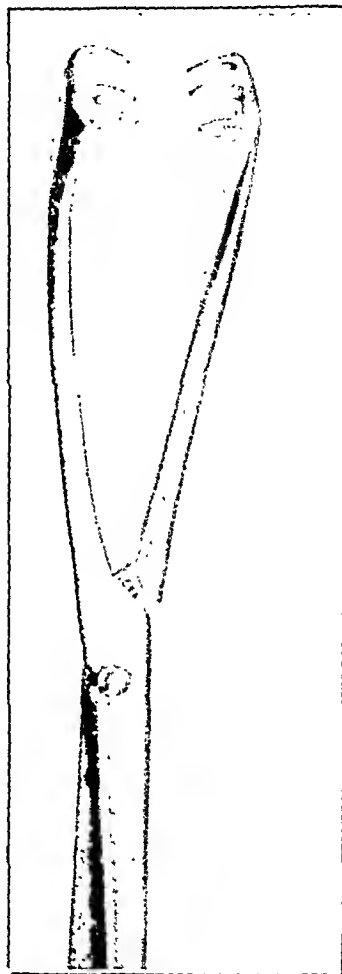


FIG. 332.—STOUT MUSEAU FORCEPS FOR TAKING FIRM BITE INTO FIBROUS TISSUE IN BISECTION OF UTERUS OR ENUCLEATION OF FIBROID TISSUE.

Well curved to keep handles out of way. Actual length 10 inches (25.5 cm.)

side and this is at once applied in a similar manner to the opposite side of the uterus on its ent surface, releasing in turn the opposite forceps on the fundus. The uterus generally is easily bisected in this way well down into its cervical portion as it is pulled up and everted like the spreading petals of a flower, without any dissection or effort to detach the cervix from the bladder. If there is the least trouble in keeping to the uterine canal in the



FIG. 333.—INITIAL STEP IN BISECTION. LATERAL STRUCTURES BURIED IN ADHESIONS. FUNDUS GRASPED BY MUSEAU FORCEPS.

bisection, take a long artery forceps, insert and open, and follow this as a director.

Next, divide one-half of the vertically bisected cervix horizontally out into its broad ligament. Immediately, the free museau grasps the horizontal surface of the divided cervix, inverts it, and as it is pulled up prettily exposes the uterine vessels. The rest of the enucleation proceeds as described in the extirpation from side to side.

Lastly, the remaining half of the uterus is removed in the same way.

The last cut in dividing the cervix on each side is the only dangerous part of the operation; here it takes a little skill carefully to cut out laterally and



FIG. 334.—BISECTION STARTED BY CUTTING BOLDLY DOWN IN MEDIAN LINE INTO UTERINE CAVITY.

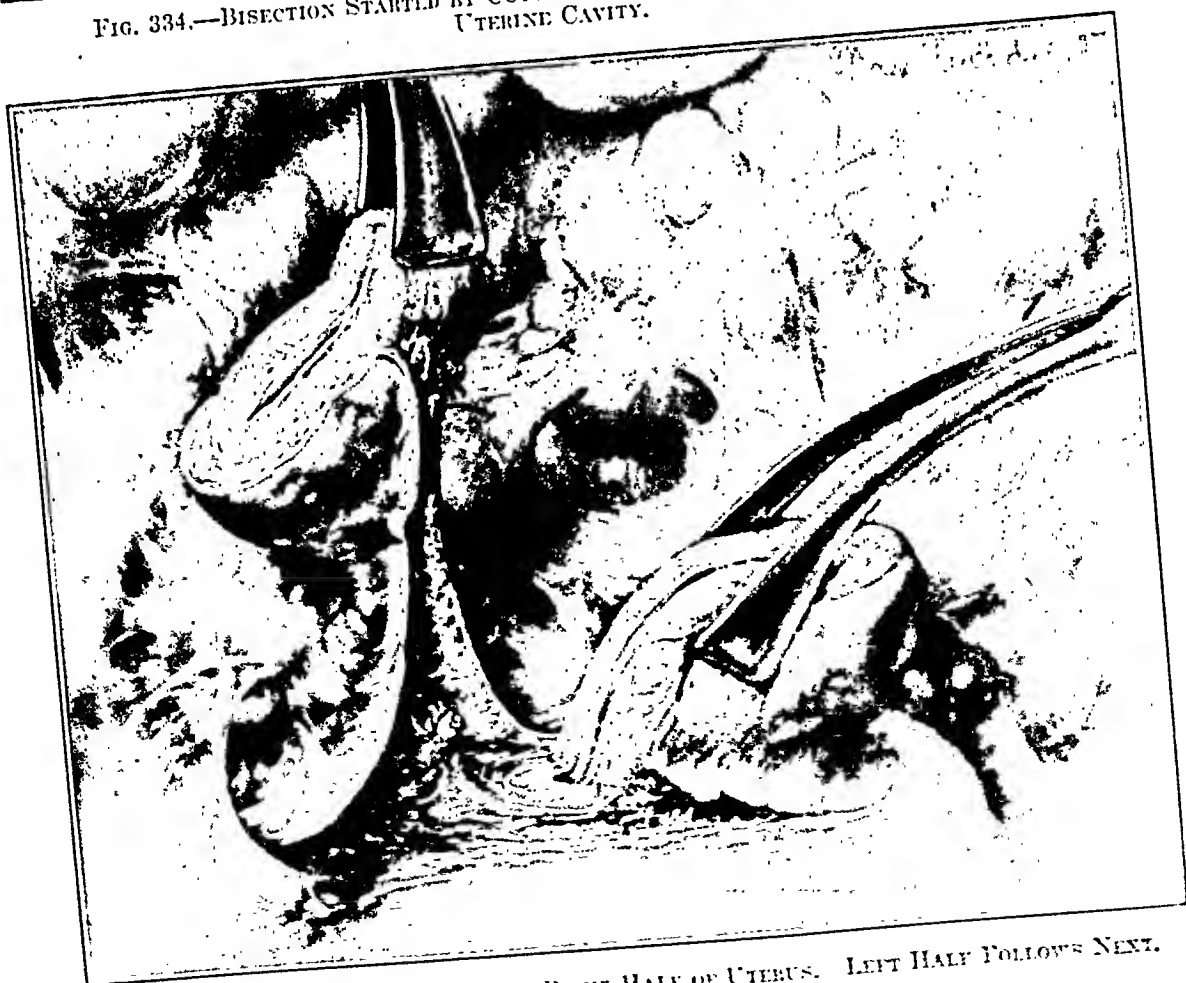


FIG. 335.—JUST BEFORE REMOVAL OF RIGHT HALF OF UTERUS. LEFT HALF FOLLOWS NEXT.

to recognize the moment the cervix is nearly divided and then to cut upward, exposing the uterine vessels for ligation at a higher level.

The uterine vessels are now either clamped with forceps or tied as exposed.

It is sometimes convenient to remove the vaginal portion of the cervix after completing the rest of the operation.

In Figure 336, the field of operation is exhibited after the removal of the uterus with adherent uterine tubes and ovaries left *in situ* to be dealt with



FIG. 336.—UTERINE BODY REMOVED LEAVING WELL-CUPPED CERVIX.

Adherent lateral structures now attacked from below or from median surfaces and readily removed.

conveniently without risk of hemorrhage and with the assurance of the possibility of a complete removal and a minimal risk of injury to the bowel and of contamination of the peritoneum.

Steady orderly progression under unremitting intelligent supervision characterizes the successive steps of the procedure, a supervision often impossible by the older methods.

It is always advantageous to cup out the cervix, even dissecting out its mucous canal down to the vagina.

Total bisection and a panhysterectomy are readily done by extending the vertical incision.

Horizontal Bisection.—This method, occasionally called for where lateral structures on both sides are extensively adherent and the fundus of the uterus is more or less completely buried and cannot be elevated for a sagittal bisection. is elucidated by Figures 337 and 338.

The bladder just below and behind the symphysis serves as a guide to the



FIG. 337.—HORIZONTAL SECTION OF UTERUS AS VIEWED BY OPERATOR THROUGH ABDOMINAL INCISION.

Above lie buried adherent fundus and lateral structures. Below is bladder, pushed down toward symphysis, exposing cervix grasped by forceps. Arrows indicate horizontal division for purpose of detaching uterus and exposing uterine vessels which are immediately clamped or tied.

uterine cervix which can also be found by pushing up its vaginal end. The bladder peritoneum is divided from side to side and the bladder drawn toward the symphysis, exposing the cervix. The cervix is then clearly exposed for a horizontal bisection by detaching the vesical peritoneum and pushing the bladder down when its supravaginal portion is grasped, Figure 337.

The exposed area of the cervix is caught next with two forceps and bisected horizontally with extreme care, avoiding injury to the uterine vessels.

A vertical incision into the cervical canal will sometimes quickly furnish a convenient hold and facilitate the effort to complete the horizontal section.

When the division of the cervix is completed, the uterus is caught by its now exposed cervical end and drawn up and away from the lower vaginal end, and in the interval the uterine vessels are exposed and clamped as high up as convenient.

With the cervix thus divided and its canal exposed, the uterine body is located and divided in its entire thickness, in a direction from below upward, on its anterior face, Figure 338.

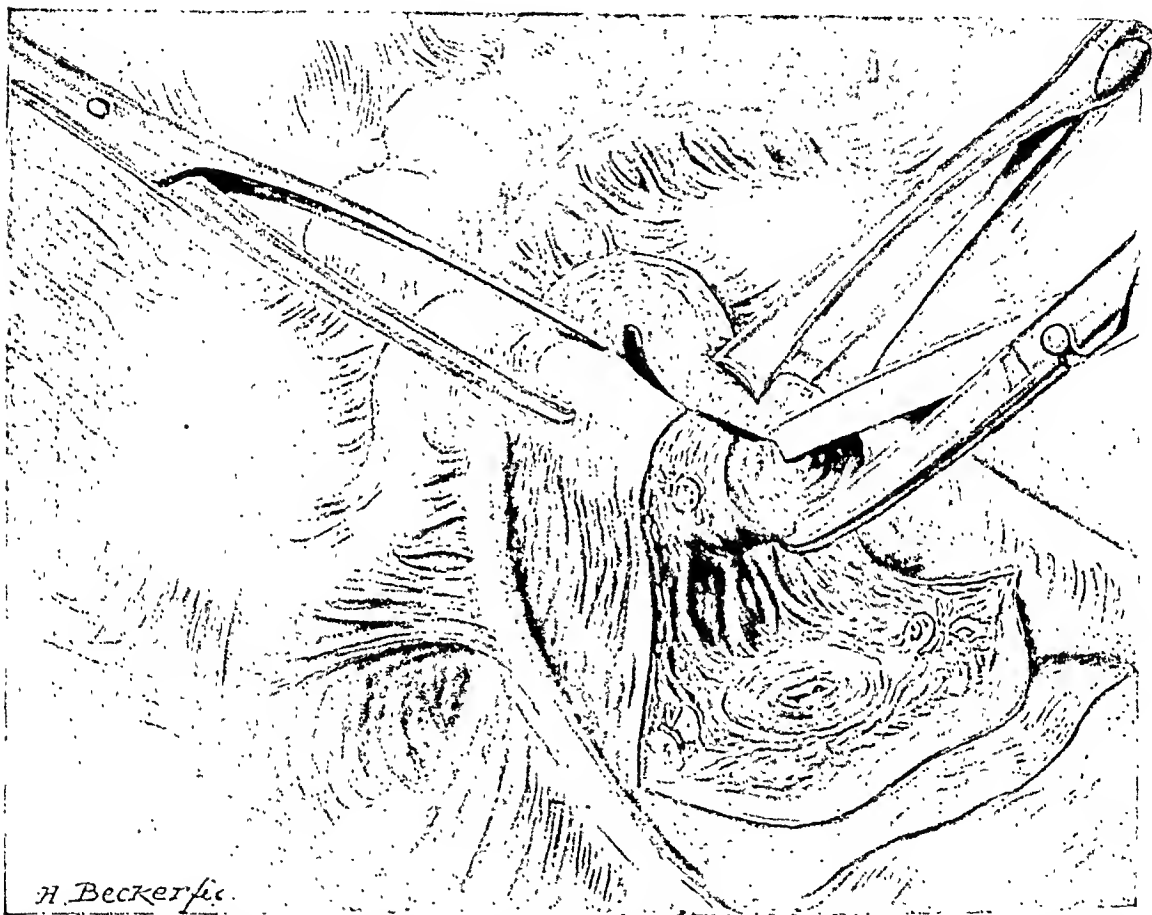


FIG. 338.—AFTER FREEING CERVIX FROM ITS VAGINAL END, IT IS HELD UP AND BISECTION COMPLETED FROM BELOW UP.

A panhysterectomy after this manner is done by opening the vaginal vault and then grasping the undivided cervix and pulling it up while the uterus is detached from the vagina and stripped out of its investments, clamping bleeding vessels *pari passu* as they appear.

After controlling the uterine vessels, in some cases the posterior half of the uterine body or, again, both anterior and posterior surface together are divided in a direction from below upward.

As the uterus is thus bisected, a large space often appears behind the cervix, offering an avenue for its separation from below and behind in a direction

upward and backward. When the rectum is closely adherent, it is sometimes best to detach it, leaving a thin layer of the uterine tissue attached.

After thus bisecting the organ from below upward, the rest of the enucleation is completed as previously described.

Drainage.—The best avenue of drainage is always the vagina, through a wide open cervix, through the cervical ring split posteriorly, or through the posterior culdesac.

Closure of the Wound.—After a thorough inspection, checking all hemorrhage, and seeing that all raw areas are covered well with peritoneum, the wound is closed.

CHAPTER XXV

VAGINAL HYSTERECTOMY

HOWARD A. KELLY

INDICATION OPERATION

Vaginal hysterectomy, at one time in great vogue both for cancer of the cervix and for fibroid tumors of any and all sizes, is but exceptionally resorted to in these latter years. This change is the outcome of the better training and greater familiarity of our operators with the more extensive abdominal panhysterectomy with its thoroughgoing control of the entire field of operation at all times under ocular inspection and above all with its associated protection of the ureters from the frequent lamentable accidents of pioneer days. Among the leading European vaginal hysterectomists of the generation just past were Schauta, Staude, A. Martin, and von Ott; the protagonists in our own country were those notable figures, F. Heurotin and W. R. Pryor.

Vaginal, in common with abdominal hysterectomy is being further restricted by the growing conviction that radium in treating carcinoma is at least as reliable as radical surgery, while dispensing with all the immediate risks of the latter.

Indication.—Vaginal hysterectomy, however, still claims a place in exceptional instances. The day has probably forever passed when this avenue will be used to extirpate large fibroid uteri. It is of value in certain extreme forms of prolapse in which the uterus is removed for the purpose of sewing together the right and left broad ligaments to create a new firm pelvic floor to support the sagging viscera. Other indications are cancer of the body of the uterus in the aged and feeble or in diabetics with a fairly lax vaginal outlet. Also, I think it should be restricted to uteri which are rather movable and avoided where there is fixation with an attendant uncertainty as to the difficulties to be met in making downward traction.

The effort in vaginal hysterectomy for *cancer of the cervix* is to do the extirpation with a substantial cuff of the vagina clinging to the cervix and then to include as much as possible of the contiguous bases of the broad ligaments in their attachments to the uterus, having in mind the clinical fact that the disease commonly spreads in this area by continuity of tissue, pushing out into and encroaching upon the immediately adjacent contiguous areas and not as a rule progressing *per saltum* or by pumping to distant glands, a notion unfortunately fostered by the incessant use of the word metastasis

which captured the imagination. That which drove so many to the abdominal route was the likelihood of injury to the ureters, an accident which, however, proved to be avoidable by insisting upon the utmost freedom of access to the field of operation by a Schuchardt incision (Chapter XL) and by a wide dissection at the vaginal vault, liberating the bladder with its ureters from uterus and broad ligaments, and then by traction and ocular inspection of the ureters with the overlying uterine arteries—solving the problem. It was my

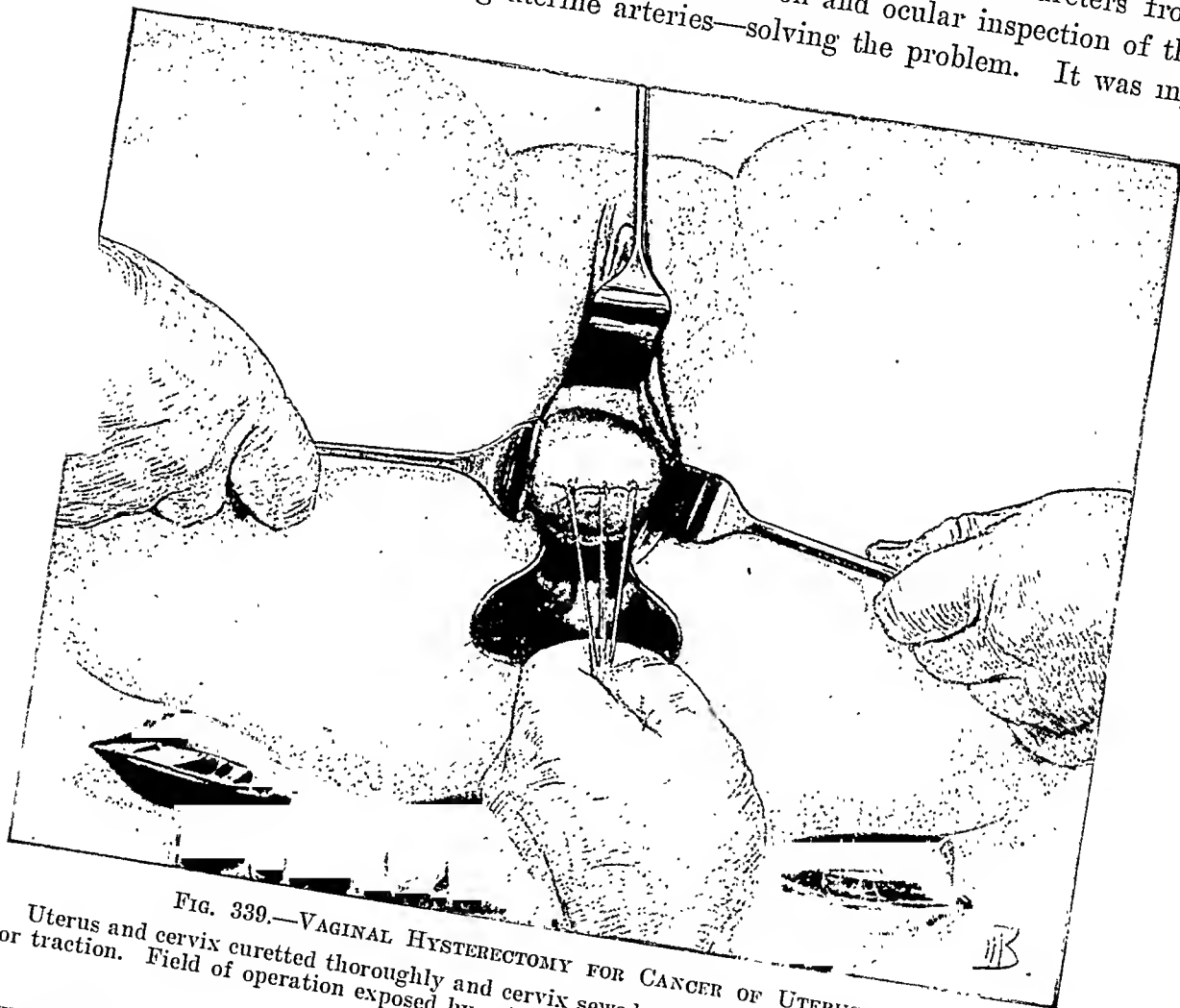


FIG. 339.—VAGINAL HYSTERECTOMY FOR CANCER OF UTERUS. Uterus and cervix curetted thoroughly and cervix sewed up with stout silk sutures left long for traction. Field of operation exposed by retractors.

own practice some twenty years since to catheterize the ureters so as to have them constantly accessible to touch whenever a wide lateral dissection seemed necessary.

If the hysterectomy is for *cancer of the body*, not advanced, the more elaborate lateral dissection of the bases of the broad ligaments is not necessary and one dares to proceed more rapidly and conveniently, working closer to the cervix.

Operation.—In brief, the objective of the operation is the enucleation of the uterus, alone if there is no cancer in question, or, in case there is a cervical

cancer, together with the bases of the broad ligaments as far out from the cervix as it can well be removed.

In the extirpation, the uterus is freed step by step and on all sides, in an orderly procedure, from its vaginal, vesical, broad ligament, and peritoneal attachments, all with the least possible injury to the enveloping structures and with a minimal hemorrhage, having in view the greatest security against secondary hemorrhage during the convalescence. Taking the major and more

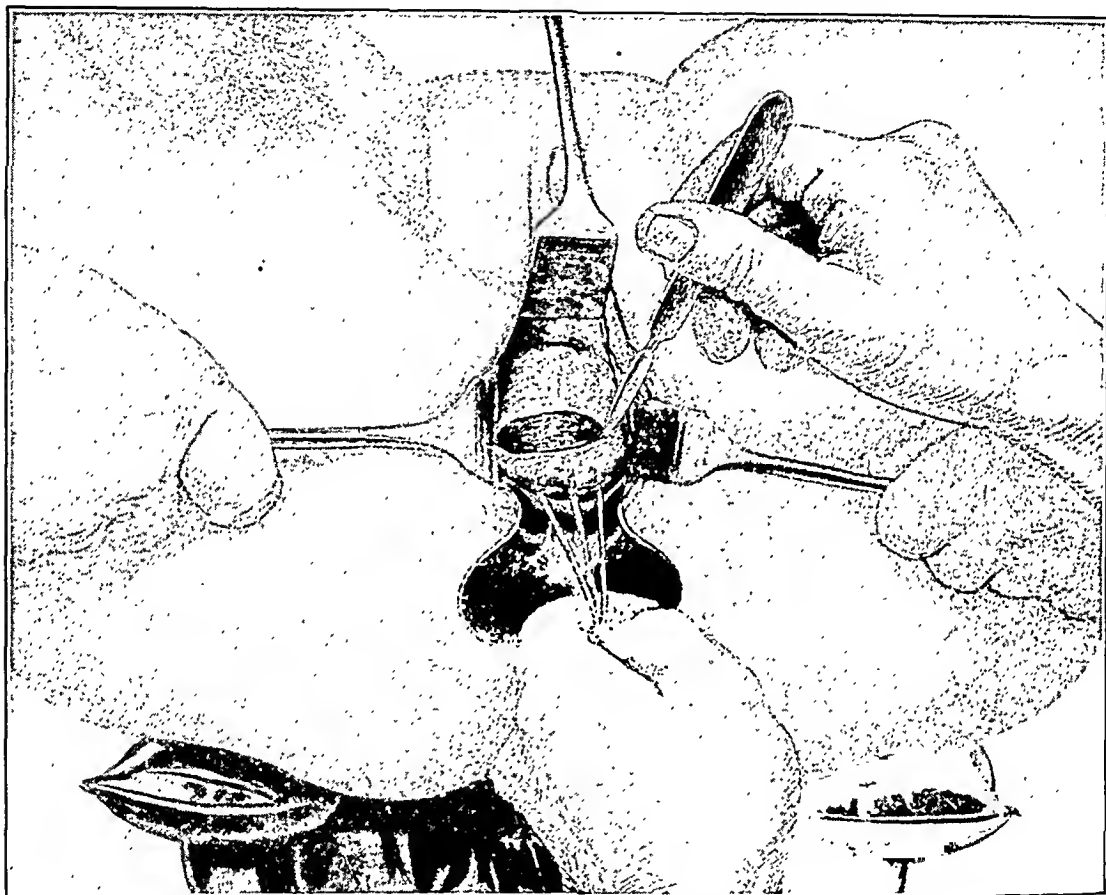


FIG. 340.—BEGINNING OPERATION BY CUTTING CERVIX LOOSE FROM VAGINAL VAULT.

difficult operation for cancer of the cervix as a pattern, the steps in gross outline are: A diagnosis of cancer confirmed by a microscopic examination of tissue taken; the clearing up of the field of operation by removing all accessible necrotic tissue and thoroughly burning out the cervix; the sterilization of the accessible cervical and vaginal areas with tincture of iodine or with a 2 per cent mercurochrome solution.

The operation in detail is:

1. In a lithotomy posture, with body slightly elevated, the cervix is seized and pulled down while an enveloping cuff of the vagina is cut through and detached on all sides at 2 or 3 centimeters distance from it out on the vaginal

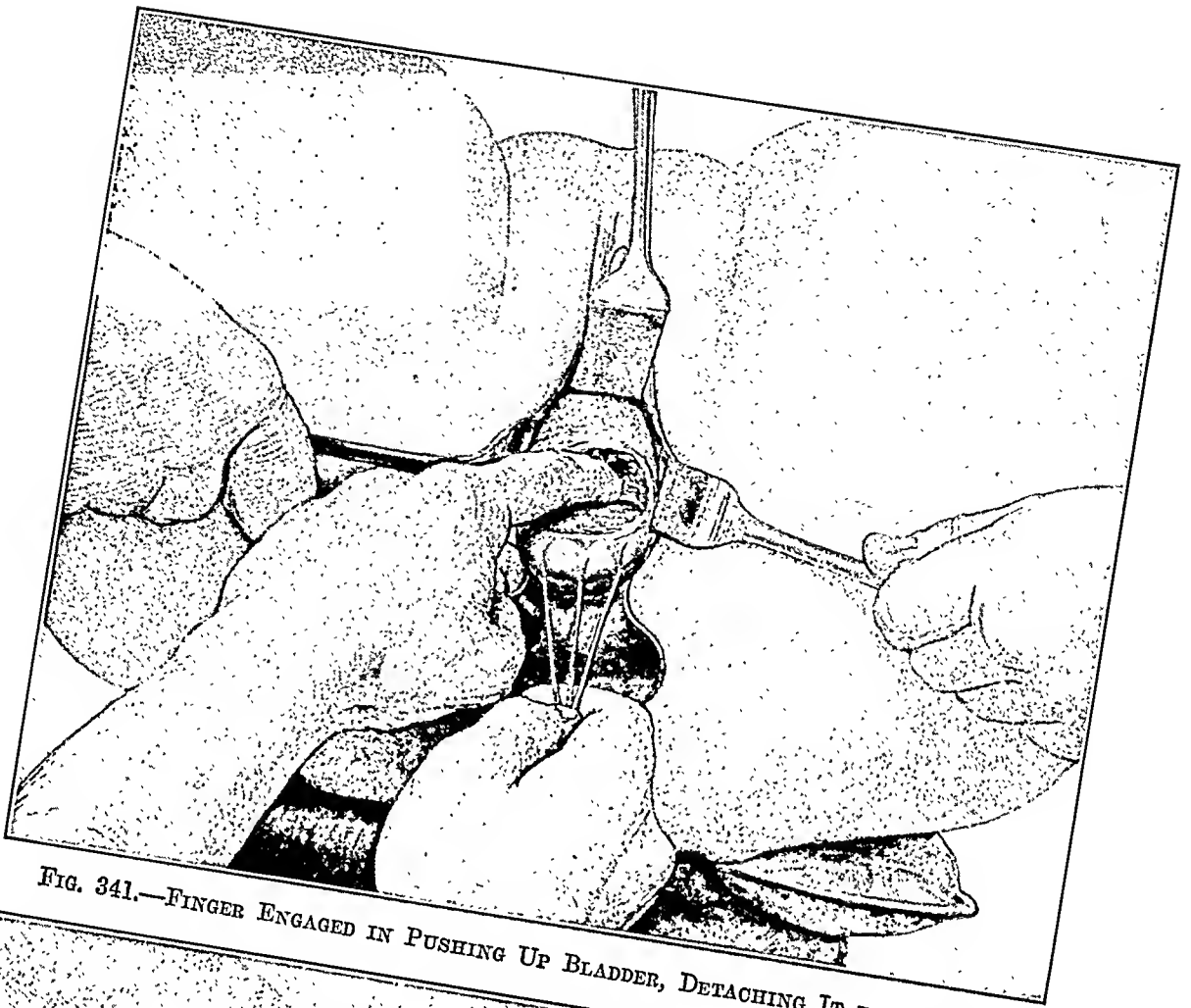


FIG. 341.—FINGER ENGAGED IN PUSHING UP BLADDER, DETACHING IT FROM CERVIX.

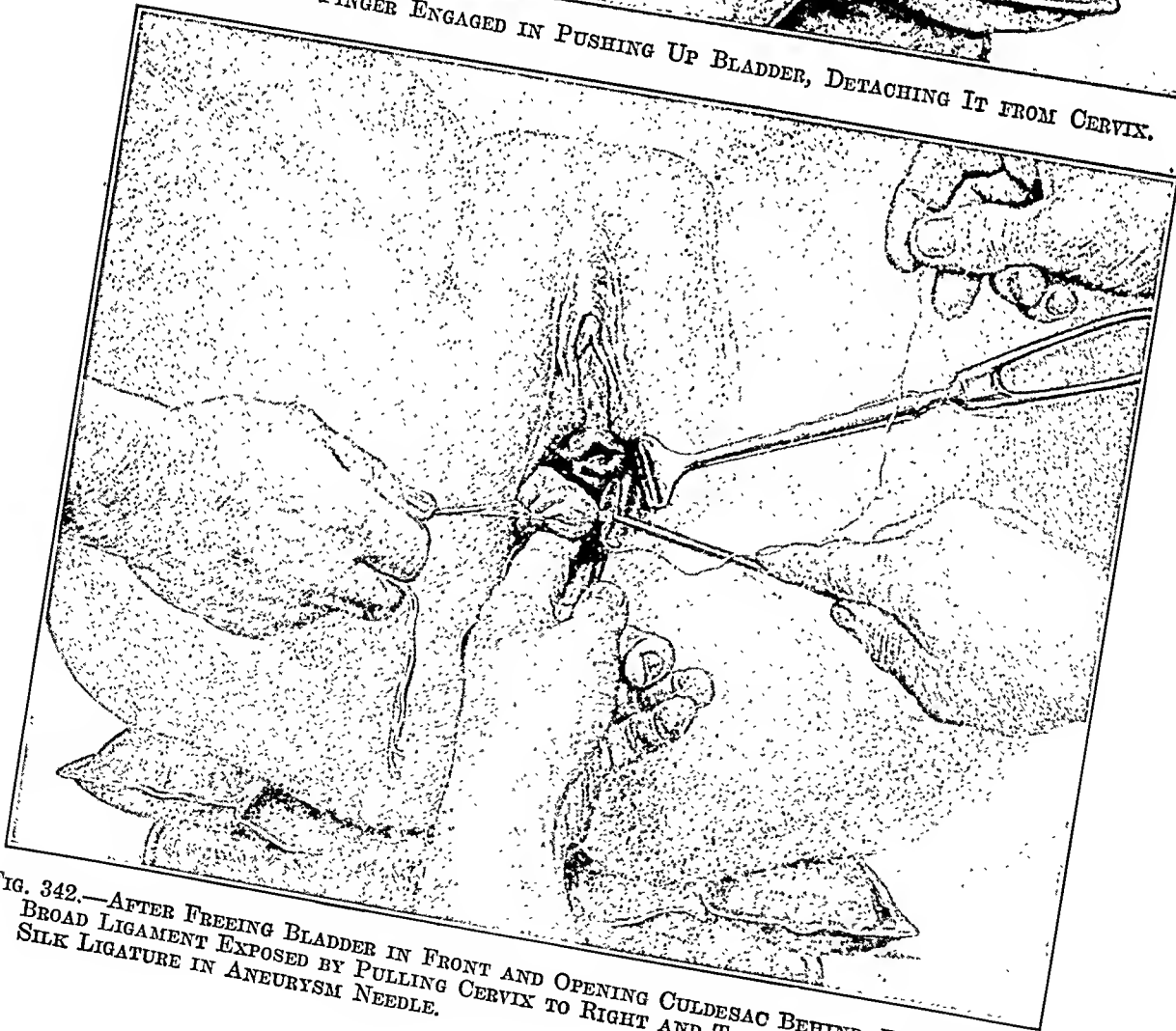


FIG. 342.—AFTER FREEING BLADDER IN FRONT AND OPENING CULDESAC BEHIND, BASE OF LEFT BROAD LIGAMENT EXPOSED BY PULLING CERVIX TO RIGHT AND TIED OFF BY PASSING STOUT SILK LIGATURE IN ANEURYSM NEEDLE.

vault; this is at once sewed up with four to six mattress-sutures left long to serve as tractors during the enucleation.

2. A longitudinal subvesical incision, extending down the anterior vaginal wall through to the bladder, is often necessary in order to give more room in freeing the bladder and in exposing the broad ligaments and at times the ureters.



FIG. 343.—VAGINAL HYSTERECTOMY.

Freeing right broad ligament from uterus: Cervix to left; first ligature to base of broad ligament tied and hanging loose; second ligature, including uterine artery, tied above first and scissors about to divide broad ligament between ligature and right border of uterus.

3. The points on each side at which the longitudinal meets the circular incision around the cervix are caught with Ochsner forceps and the vagina liberated from the bladder by a blunt dissection which is continued on up in front of the uterus as far as the vesicoperitoneal reflection, opened, and stretched wide with the index fingers. It is important not to bore through to the peritoneum but to free the bladder wide on all sides. Up to this point, the operation resembles that done for a prolapsus interposition.

4. The posterior culdesac is opened wide from side to side. In thus freeing the cervix and the body of the uterus in front and behind, it is of great advantage to use rather blunt-pointed, stout, curved scissors and to keep

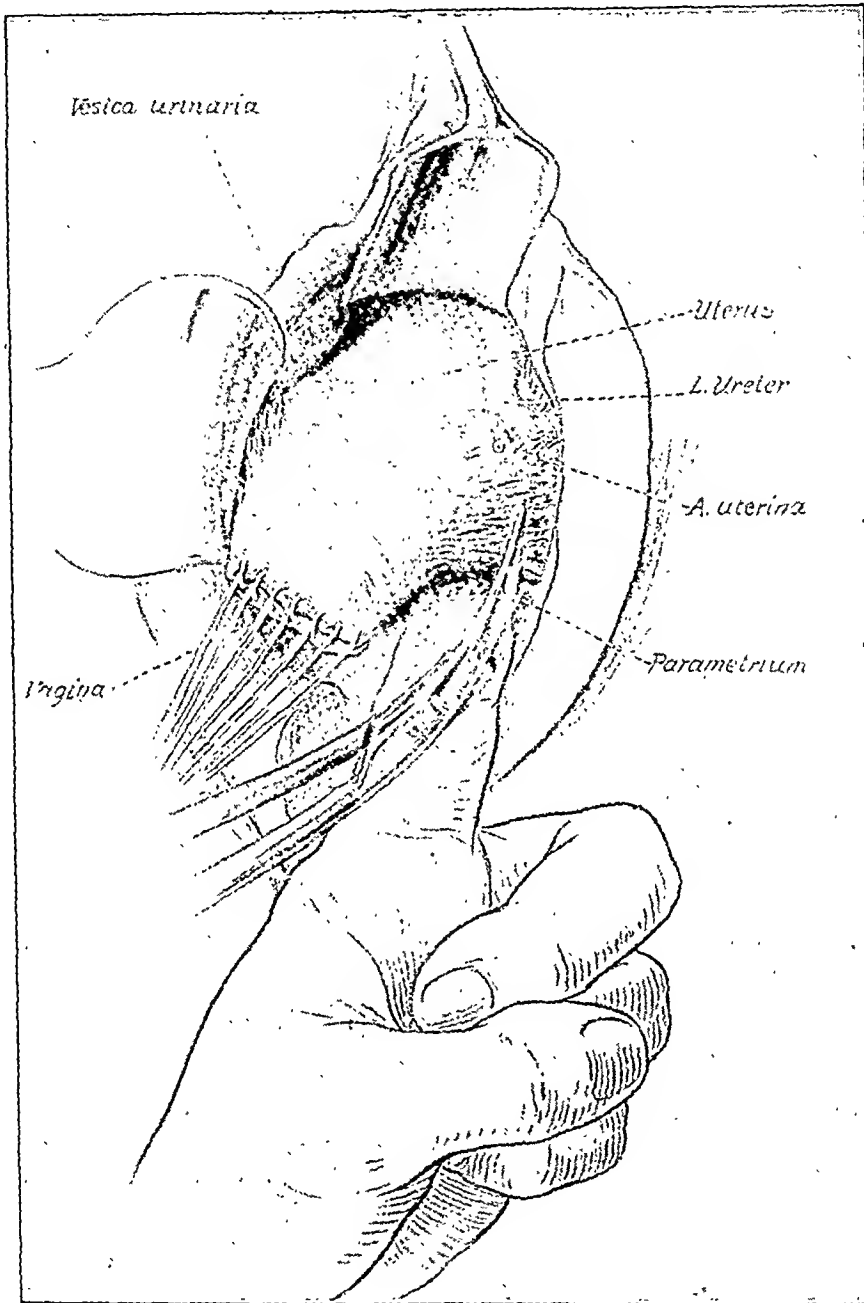


FIG. 344.—WIDE DISSECTION EXHIBITING BASE OF BROAD LIGAMENT AND URETER ABOVE AND DIVISION OF BROAD LIGAMENT AT A DISTANCE FROM CERVIX WITHOUT RISK OF INJURY TO URETER. (Döderlein and Krönig.)

the clipping or expanding ends of the scissors (in whichever way they are being used) at all times directed toward the uterus, sparing the bladder and the rectum from injury.

5. The uterus now remains attached only by its broad and uterosacral

ligaments below, stretching out laterally and posteriorly to the pelvic wall, and above by the infundibulopelvic and round ligaments which lead posteriorly in the direction of the sacro-iliac joint and forward to the inguinal ring.

6. The tubes and ovaries can now be examined through the posterior opening and if adherent freed.

7. By hooking down first one uterosacral ligament and then the other and passing a ligature with a round or an aneurism needle and dividing and



FIG. 345.—VAGINAL HYSTERECTOMY.

Cervix and uterus pulled well over to left. Right broad ligament tied all the way to top, to be tied next. Index finger hooked behind top of broad ligament, pulling it down into view for last ligature.

freeing these ligaments from the uterus, considerable increased mobility is available. By hooking a ligament down, the danger of catching a ureter, ever to be borne in mind, is avoided.

8. Similarly, the bases of the broad ligaments are hooked forward and ligated at a point well out laterally and away from the uterus, thus further freeing the cervix.

9. With the detachment of the cardinal ligaments, releasing their hold on the cervix, the latter is freed to such an extent that the uterus can be

drawn yet further down and the ureter with the uterine artery lying just above it brought into easy view. Such an exposure simplifies greatly the passage of one or more ligatures, also at a distance from the uterus, controlling the circulation by ligating the uterine vessels, while at the same time avoiding injury to the ureters.

10. With the uterus thus remaining attached only by the upper part of the broad ligaments, the succeeding steps of the ligation of the upper part of

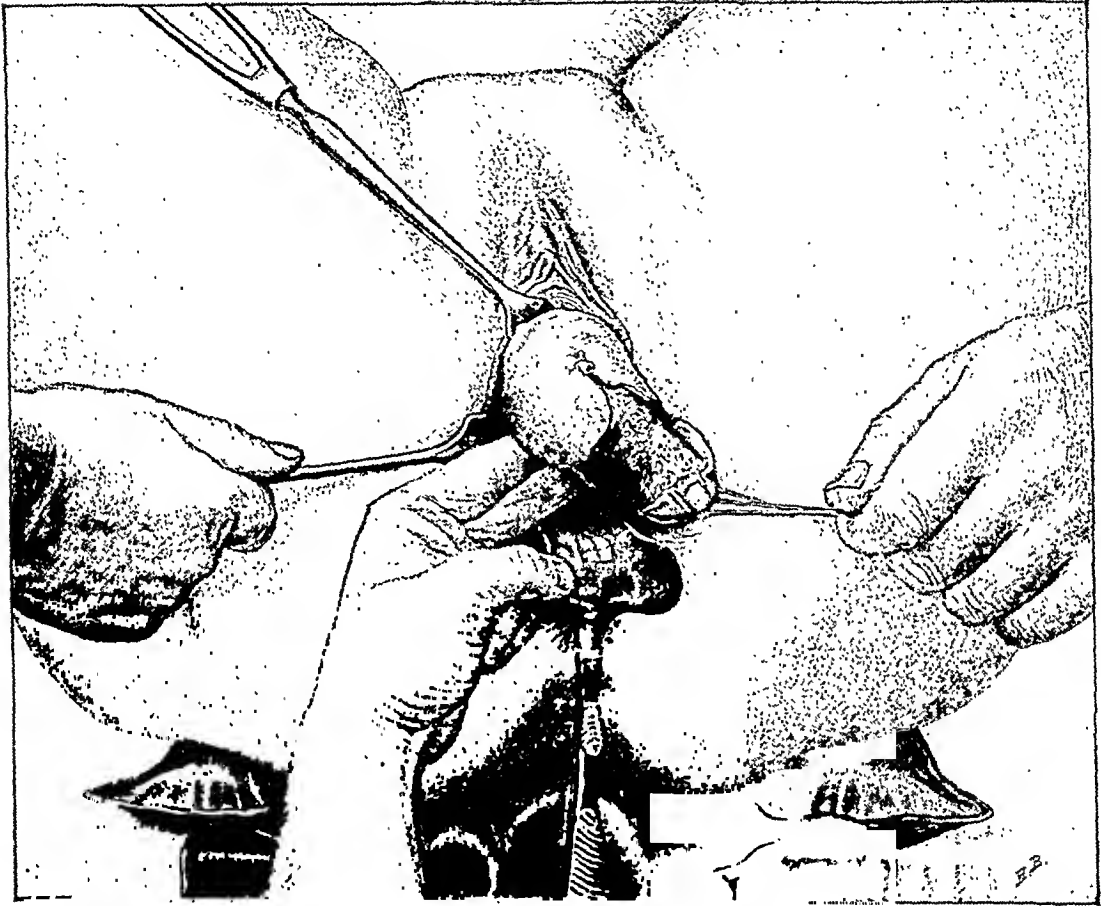


FIG. 346.—VAGINAL HYSTERECTOMY.

Uterus entirely freed on right side and brought out on to vulva. Remainder of left broad ligament now tied from above downward.

the broad ligaments, whether with the purpose of leaving the ovaries and tubes *in situ* or of removing them, are easily effected.

11. A way of completing the enucleation after ligating the uterosacrals and the bases of the broad ligaments, is, on opening wide the vesico-uterine peritoneum, to pass a flat retractor or a long thin Sims speculum up under the bladder to lift it out of the way while exposing the fundus of the uterus and hooking it down, drawing it outside, and completing the enucleation from above downward, first on one side, then on the other. T. S. Cullen has a way of bringing the fundus down and out by passing traction sutures through

the anterior face of the uterus successively higher and higher until the fundus comes down and appears at the vulva. The final step of controlling the upper broad ligaments can be more quickly done with strong forceps, clamping first one side and then the other and completing the enucleation and applying the

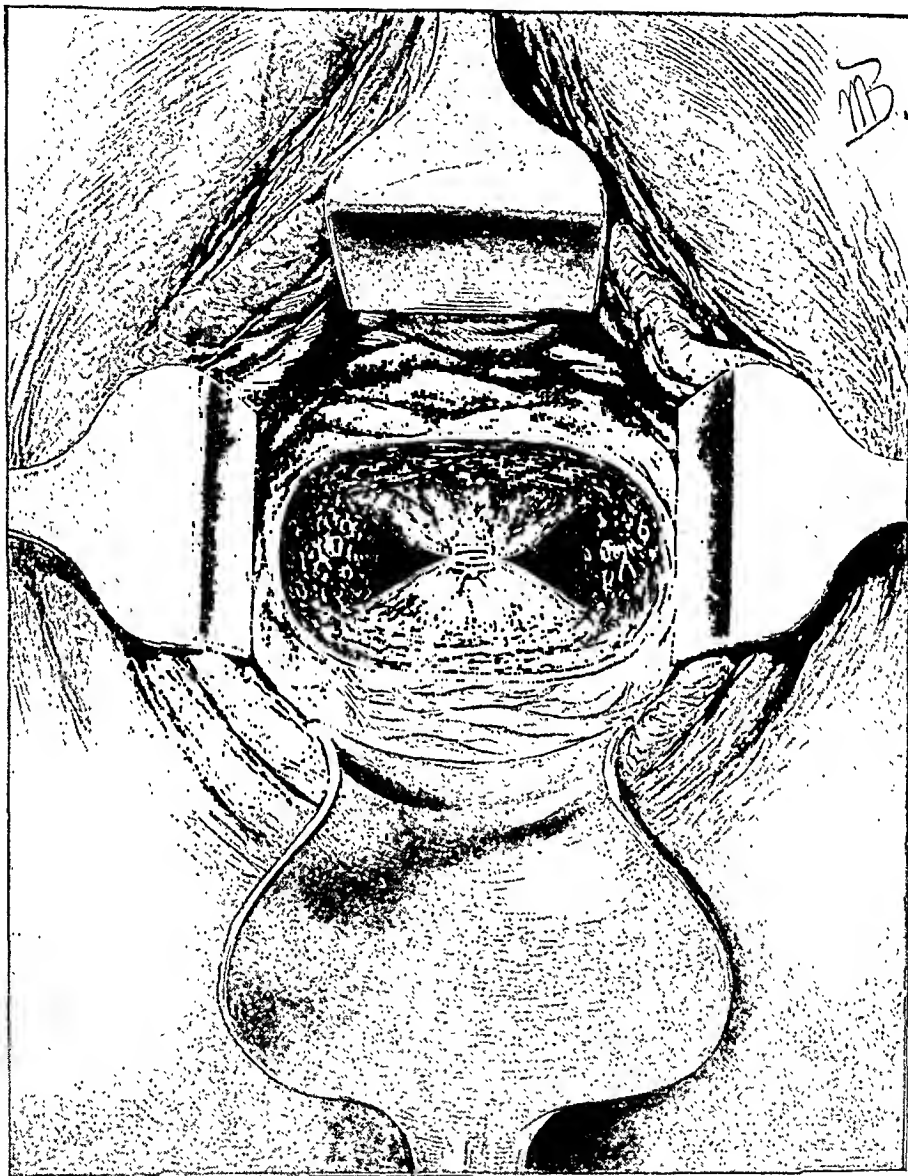


FIG. 347.—VAGINAL HYSTERECTOMY.

Uterus removed; ligatures on uterine arteries on both sides. Anterior and posterior peritoneal layers brought together in middle by one suture.

ligatures afterwards. The French have made extensive use of forceps left on for at least forty-eight hours after the operation, in place of ligatures (*pincés à demeure*). In our country, though carefully tested out for a time, this practice has been abandoned. If forceps are used at all, great care must be taken in applying the ligatures replacing them to avoid hemorrhage. This is best done by distinguishing the exact place where the uterine and the ovarian

arteries are divided, also by not passing the ligatures too superficially into the tissues, while ever bearing the ureters in mind.

12. Finally, a careful examination gives assurance that there will be no hemorrhage.

13. The vesical peritoneum is brought down to the vagina and sewed there or is drawn forward and sewed under the neck of the bladder at the internal urethral orifice if there is any cystocele (G. L. Hunner), after which the longitudinal incision is closed.

14. A washed-out iodoform gauze drain, enveloped in rubber protectives, is now inserted through each of these openings up to the pelvic floor to act as a drain for two or three days, and a loose pack is put in the vagina to be changed once in twenty-four hours.

The most rapid extirpation of the uterus is undoubtedly that of E. Doyen whose operation follows that just described up to the point of the complete separation of the bladder from the uterus which now hangs, as it were, by its broad ligaments in the pelvis. The characteristic steps then follow:

1. The uterus is drawn forcibly down by strong forceps on the right and on the left, grasping the cervix in its entire thickness.

2. With stout scissors, the anterior face of the uterus is bisected through the cervix and grasped again up in the angle on both sides and pulled down, then step by step using small strong museau forceps the cutting upward is continued, pulling the uterus down *pari passu* and grasping again up in the angle with the forceps for the next incision until the fundus is reached and the body of the uterus brought doubled on itself wholly outside. With a little gentle manipulation with index and middle fingers, the tubes and ovaries are also liberated and brought into view.

3. The enucleation is completed by passing strong straight forceps first from below up to control the bases of the broad ligaments, and, second, from above down to overlap the first, so grasping the whole of the broad ligament. The first side so controlled is freed by cutting from above downward between uterus and forceps. This facilitates the rapid control of the remaining side in like manner clamped and detached, completely freeing the uterus.

4. Ligatures can now be substituted for the forceps, although Doyen and J. L. Faure, following him, controlled the vessels by the forceps, using no ligatures.

G. L. Hunner's method, clearly and simply stated, is especially suited to patients with marked relaxation and descensus:

1. After placing the patient in the dorsal posture and inserting a broad Sims speculum, protect the vaginal walls from heat with heavy asbestos board.

2. Three cautery irons of varying sizes (the common familiar tinner's

cautery), are heated with gasoline blow torch and used to burn out the cervix into a cone. The advantage of this is that the heavy cautery iron sinks in more rapidly than the curet and obviates as well the theoretical danger of dissemination.

3. A deep vaginal incision is made beginning beneath the urethra and carried down the anterior wall in the median line to the cervix where it is continued transversely in the \perp form which is extended completely to encircle the cervix. This incision can be made with the electric cautery wire, preventing most of the bleeding from the vaginal wall rim.

4. The vaginal walls are dissected away from the bladder on each side, beginning where the longitudinal meets the transverse incision.

5. The bladder is further freed extensively on all sides and up to the vesical peritoneum, as in an interposition operation (Chapter XIX).

6. The peritoneum is opened in front, the posterior vaginal walls bluntly pushed from the cervix, and Douglas's culdesac opened wide from side to side; the uterus now hangs in the pelvis by its broad ligaments.

7. A ligature is passed behind on both sides to tie off the uterosacral ligaments, taking care to catch each ligament separately between thumb and forefinger interposed to keep the ureter out of the way and pushed out toward the pelvic wall while the ligature is being passed and tied and the ligament severed from its uterine attachment. This detachment permits greater mobility during the subsequent steps.

8. The index finger is hooked around the cardinal ligament at the base of the broad ligament and pushed forward through the broad ligament close to the uterus. Then sweeping the finger out laterally, the vascular tissue of the broad ligament above the finger, including the uterine arteries, is bluntly separated from the cardinal muscle or ligament below the finger, freeing the ligament for ligation at any convenient point and distance from the cervix.

9. The ureter must constantly be borne in mind. If looked for, it is found lying with the bladder on a plane above the tissue which is hooked downward for ligation.

10. Both cardinal ligaments are now tied and severed, leaving the uterus loosely attached only by its vascular connections with the uterine and ovarian vessels, including the round ligaments and the relatively lax upper two-thirds of the broad ligaments.

11. The body of the uterus is tilted forward into the vagina and a double ligature is placed to embrace the fallopian tube, utero-ovarian ligament, and the round ligament, that is to say, the upper third of the broad ligament.

12. The middle third of the broad ligament with the uterine arteries is ligated as far laterally as possible, noting especially that the ureter is not included, pinched, or compressed in any way.

13. When the uterus is thus severed on the more yielding side, if there is any difference, by drawing it over in lateral displacement, the more difficult

side is rendered more approachable and the ligation continued there in like manner in a direction from the cornu down to the large uterine vessels. The operation lasts, on an average, about half an hour.

14. If the patient has had a cystocele, this is relieved by sewing the vesical peritoneum well forward, catching it in a suture, uniting the vaginal walls beneath the urethra.

15. A purse-string suture of chromic catgut is now passed through the edge of the vagina just beneath the urethral sphincter, then through the stumps of the upper third of the broad ligament, the cardinal, and the uterosacral ligaments, and then across to the opposite side, taking up the several ligaments in inverse order, finally to emerge through the vaginal edge opposite to the point of entrance. When tied, this "*omniaium gatherum*" purse-string suture gives the bladder excellent support.

The remaining incised vaginal walls are approximated with interrupted catgut sutures; in the absence of oozing, a carefully placed gauze pack keeps the vault in good position.

A flap-splitting exposure and approximation of the levator ani muscles often also contributes to complete the pelvic floor support.

It is well in the early cases to insert a cigarette drain in the peritoneum at the vaginal vault for a few days.

CHAPTER XXVI

BACKACHE

ROBERT W. JOHNSON, JR.

SPINAL ANOMALIES

Spina bifida occulta

Sacralization or Fusion of Fifth Lumbar Vertebra

Incomplete Sacralization of First Sacral Vertebra

Scoliosis

Impinging Spinous Processes of Lower Lumbar Vertebra

MECHANICAL FACTORS

Lumbosacral Strain

Sacro-iliac Strain

Spondylolisthesis

Posture

PATHOLOGICAL CONDITIONS IN BONES AND JOINTS

Fractures

Tuberculosis

LUMBAR SPINE AND SACRUM

SACRO-ILIAIC JOINTS

Arthritis

INFECTIOUS

HYPERTROPHIC OR OSTEO-ARTHRITIS

Metastatic Lesions

Other Causes

NEUROLOGICAL CONDITIONS

In the differential diagnosis of backaches, the back itself must first receive careful consideration, since but few of those complaints in women are attributable, as commonly thought, to reflex intrapelvic disorders. Both from the developmental and from a purely mechanical standpoint, the lower spine and pelvic girdle are a common site of anomalies and mechanical faults predisposing to strain and subsequent back symptoms. We also have to deal with a large group of arthritides where the symptoms are referable to the soft tissue or to bony changes just about the vertebral joints rather than to any visceral disease or to the commonly suspected "kidney trouble." We also frequently meet pathological changes in the bones.

Only in comparatively recent years has this wide field been opened up and rationally dealt with by our skilled orthopedists who alone are competent to

deal with most of the members of this group and whom the wise surgeon will hold as a court of reserve when his patient does not respond to his simple initial efforts to give relief.

The gynecologist is interested because so many come complaining of their lumbosacral backs. Only a few decades ago, these were labeled as reflexes of a pelvic disease, generally a uterine displacement, and relief was confidently promised with the correction of the displacement.

A careful history often reveals as many as three kinds of backache in one patient, provided she is intelligent enough or sufficiently observant to define her aches and pains. Many patients present some orthopedic condition complicated by an intrapelvic displacement or an old chronic inflammatory condition, considered cured but leaving adhesions, which to the gynecologist is not enough to explain the persistent lumbar pain, leaving him at a loss as to its source. Such intrapelvic conditions should be corrected before the orthopedist handles the chronic condition. It is a wiser policy, therefore, not to promise a cure by operation without the orthopedist's report.

These women, although still complaining of a backache after operation, often admit that it differs from the previous pain but that until closely questioned they had not noted the difference, their disappointment being that they had been led to expect entire relief from the operation. The relapse occurs when they begin to resume normal activities and the pain returns. The surgeon having risked his all in his effort and lost, soon wearies of his patient's complaints and she drifts beyond his ken.

We know now that most of these persistent backaches are sacro-iliac luxations or lumbosacral strains and as a rule readily respond to appropriate therapy. It is advisable, therefore, that the gynecologist recognize and treat the more obvious of these ailments, not forgetting, however, that a large group of other ailments may provoke similar symptoms; if, therefore, an x-ray plate to exclude some of the more conspicuous lesions and a simple effort to relieve do not solve the problem, he had better resort to his orthopedic colleague.

The several orthopedic conditions causing backache, which are to be borne in mind in making a differential diagnosis and tracing the symptom to its source, are here outlined.

Spinal Anomalies.—*Spina bifida occulta.*—*Spina bifida occulta* or concealed spina bifida, of the lower lumbar and upper sacral regions, is one of our common developmental defects, usually involving the fifth lumbar vertebra or the top of the sacrum. The defect is unimportant *per se*, but by reason of the lack of fusion of the laminae with the attendant absence of a proper development of the vertebral spinous processes there is an insufficiency in the attachment surface necessary to stabilize the important ligamentous and muscular structures centering in this region; hence, it becomes a grave source of potential weakness at a point of unusually mechanical stress and is a frequent cause of low back strain. Symptoms and treatment are discussed under lumbosacral

strain. The diagnosis is clarified by the x-ray findings, although the discovery of a slight depression over the spinous process or a pit in the skin in the mid-line over sacrum or coccyx is suggestive. Infrequently there is an extra center of ossification in one of the vertebræ, a developmental attempt to add part of a vertebra to that normally found.

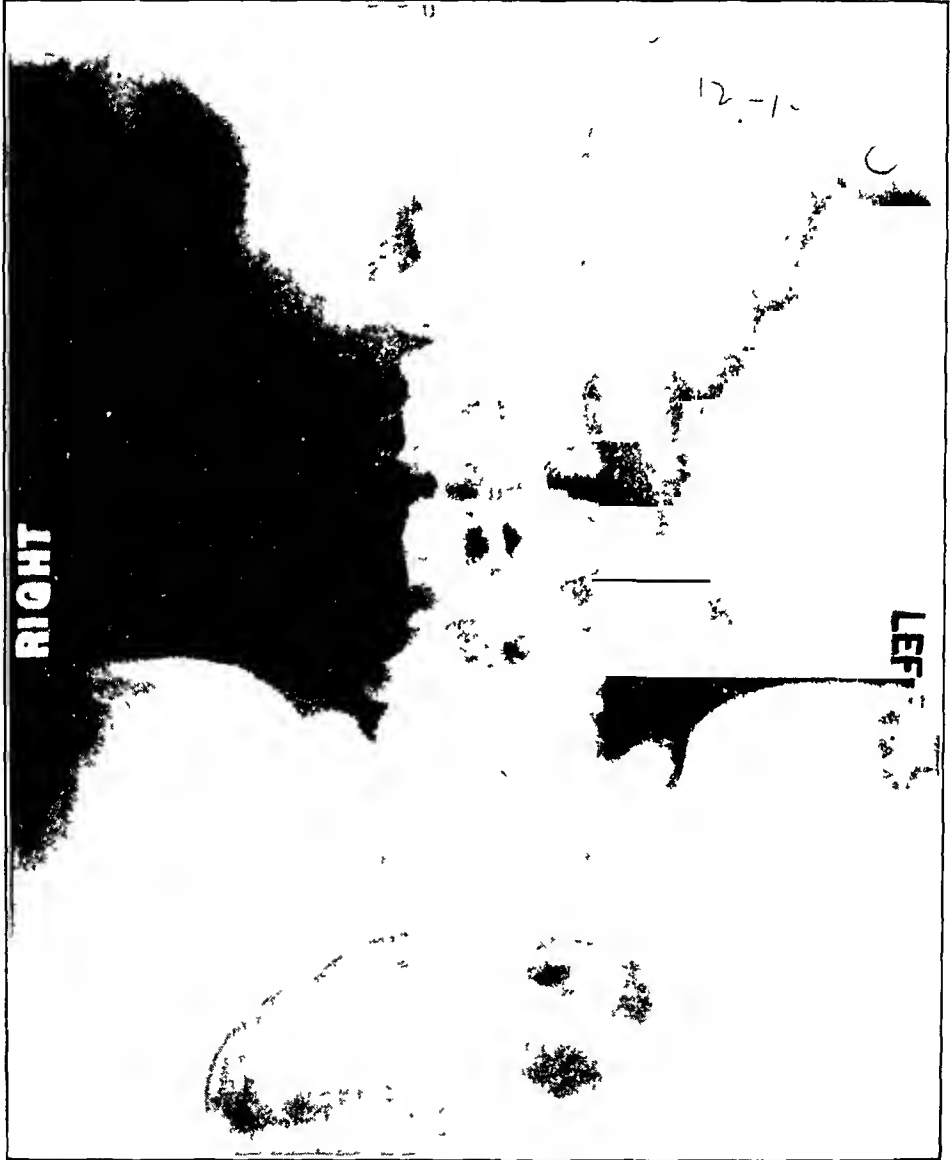


FIG. 348.—ANOMALOUS FIRST SACRAL VERIEBRA PARTIALLY SACRALIZED ON RIGHT SIDE. An obvious opportunity for strain or mechanical causes to give rise to severe backache.

Sacralization or Fusion of the Fifth Lumbar Vertebra.—This may be complete, or partial when it involves but one transverse process. The fusion of both transverse processes with the wings of the sacrum results in the reduction of the mobile elements of the lower back and so throws an increased mobility strain on the fourth and fifth lumbar articulation, giving rise to symptoms at that point. When the fusion involves but one side, the danger is even greater,

due to the fact that the mobility is then asymmetrical and unbalanced, enhancing the liability to strain and injury. The diagnosis rests upon and is easily made by the x-ray findings. The symptoms and treatment are considered under the mechanical group.

Incomplete Sacralization of the First Sacral Vertebra.—The reverse of the condition just described, or preternatural mobility of the first sacral vertebra, provides an insecure foundation for the lumbar spine, the first sacral being the largest and most important element in the sacral pediment. The sacro-iliac articulation is in this way reduced in size and rendered more pliable, furnish-

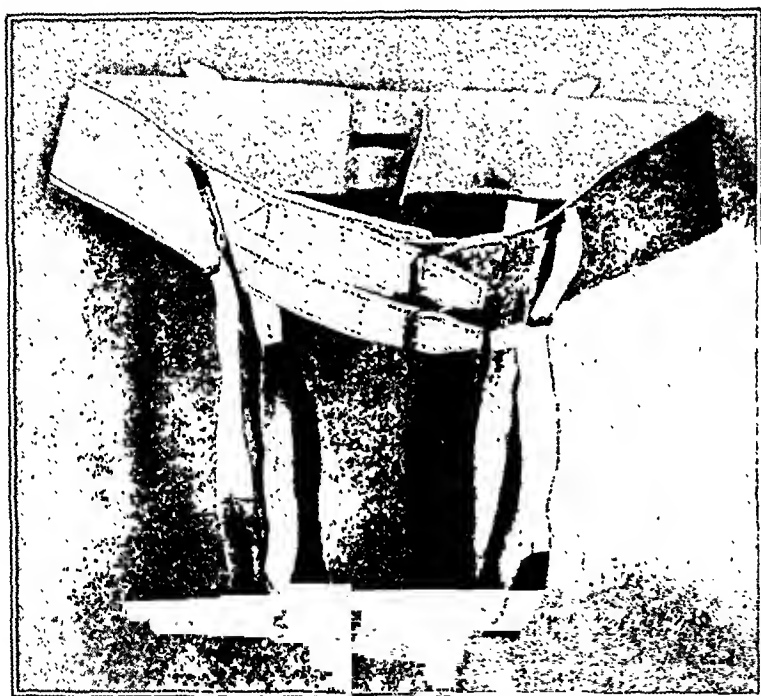


FIG. 349.—BUCKSKIN SACRO-ILIAC BELTS, 2½ INCHES WIDE.

Useful especially at night when corsets are necessarily discarded.

ing either lumbosacral or sacro-iliac strain as its common sequel. The diagnosis is illuminated by and depends wholly upon the x-ray plate, Figure 348.

Scoliosis.—A lateral asymmetrical development of a sacral or a lumbar vertebra often causes a lateral curvature and starts a long line of sequelæ of anatomical and mechanical defects which find their expression in pain in the lower back. The diagnosis, made by inspection and palpation, is accurately delineated by the x-ray skiagraph.

Impinging Spinous Processes of Lower Lumbar Vertebra.—An enlarged spinous process of a lower lumbar vertebra sometimes impinges on the process of an adjacent vertebra and so causes a lower backache. The pain is quite severe and increases on bending forward and stretching the intraspinous ligaments and on bending backward and increasing the pressure on the spinous processes involved. Lateral x-rays reveal this anomaly clearly; the only known

cure is the fusion of the peccant spinous processes. A good strong supporting corset or brace often gives temporary relief.

Mechanical Factors.—We have noted above the commoner developmental causes of weak back with their resultant back strain and backaches. In addition to these striking anomalies, there remains a large group of spines anatomically normal which from strain or trauma have become so distorted as to cause serious troubles, acute and chronic.

Lumbosacral Strain.—The fifth lumbosacral articulation, a strong and well-supported joint, is subjected to unusually acute or chronic stress and strain

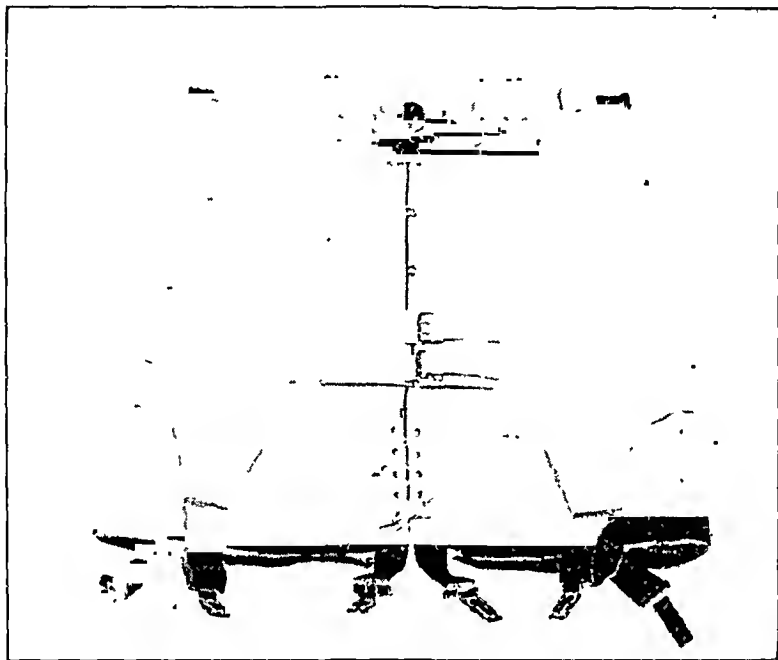


FIG. 350.—FRONT VIEW OF LACED BACK CORSET FOR STOUT PATIENT, WITH TWO SURGICAL STEEL REËNFORCEMENTS AND A WEBBING PELVIC BAND TO SUPPORT SACRO-ILIACS AND AFFORD FIRM BASE FOR SUPPORT OF LUMBAR REGION.

by reason of its location at the junction between a solidly fixed and a flexible mobile section of the body. The acute ailment is relatively easy of recognition by the history of its onset, the definitely localized pain, the signs of muscle spasm, the limitation of motion, and local tenderness. The chronic strain is more puzzling, and diagnosis, signs, and symptoms are less clear cut, while the pain is less sharply localized and frequently associated with referred pain at the extremities. The tenderness, however, while more diffuse, has its maximum over the lumbosacral junction; while it may be unilateral it often involves both sides and the midline region. Muscle spasm of the erector spinæ group is marked and mobility decidedly limited, especially in hypertension. X-ray is of no value unless it happens to exhibit one of the developmental anomalies described as predisposing to the strain. Treatment should be conservative at first and should rely upon support by reënforced corsets, massage, baking, and

graduated exercises. Occasionally it may be necessary to resort to operative fusion or bone-graft to immobilize the point of strain.

Sacro-iliac Strain.—While the sacro-iliac joint possesses a true joint structure, it is more of a shock absorber than a mechanism of mobility and normally remains relatively immobile, due to its strong and closely attached binding ligaments. When, however, the body is flexed and tilted to one side with knees held straight, a great leverage is exerted upon the joint. This form of strain is found especially during the latter months of pregnancy or during labor, owing to the marked physiologic relaxation of all pelvic ligaments, a relaxation also noted occasionally during menstruation.

In acute strain, the history is definitely that of a sudden knifelike catch or "give" in the back while stooping or lifting. The pain is immediate, unilateral, and localized over the articulation at first, often with severe referred pain down the course of the sciatic nerve or radiating about the outer thigh or gluteal region. Examination shows deviation of the spine to the opposite side on standing, marked local tenderness over the joint in front as well as at the back, and extremely marked limitation of motion and local pain over the joint when the straight leg-raising test is done. There is also

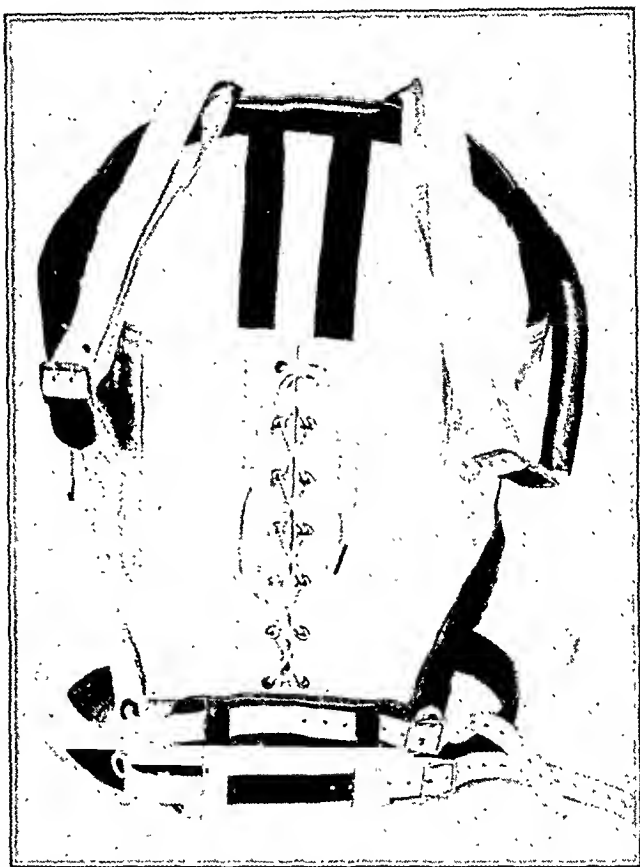


FIG. 351.—COMPLETED BACK BRACE, SHOWING ABDOMINAL PAD, LACED APRON, AND PULL-BACK STRAPS FOR SHOULDERS.

spasm of the muscles and limitation of motion in the lumbar spine; forcing the iliac crests together intensifies the pain.

In the chronic form, the history and findings are less clear cut and referred pain to the leg is often the most salient feature. However, the muscle spasm, the leg-raising test, and local tenderness form a picture usually definite enough to clinch the diagnosis after excluding other possible factors. X-rays are of no value as even in the severe cases the displacement is not great enough to be demonstrable.

In acute cases, adhesive strapping or a 3-inch band (a surcingle webbing), drawn tightly about the pelvis and anchored below the anterior superior spines,

usually furnishes an efficient support, Figure 349. In chronic form, a manipulation of the joint under anesthesia to overcome the secondary hamstring contracture is usually required and should be followed by plaster immobilization for ten days and later by a corset reinforced with the pelvic band, Figure 350. In extreme cases, it may even be necessary to resort to an open operation to fuse the affected joint.

In the gynecologist's consulting room, the complaint is often heard that the trouble beginning after a childbirth has persisted ever since, often with

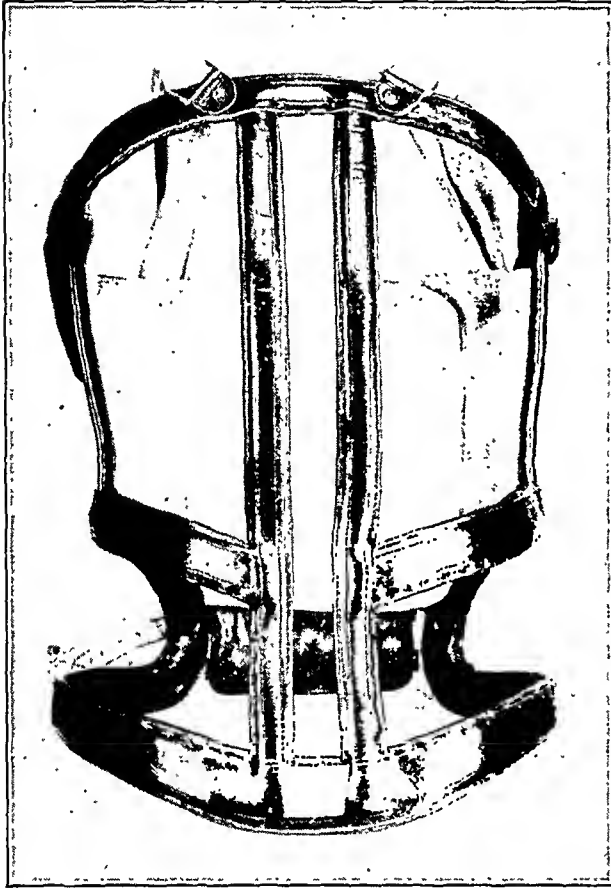


FIG. 352.—POSTERIOR VIEW.

The pelvic grip should fit closely about the iliac crests but avoid any pressure on the bone margins and anterior superior spines.

over the top of the sacrum and is readily seen in a lateral x-ray, clinically obvious from the extreme abrupt lordosis, Figure 353. The deformity can be seen and felt, as the spinous process of the fifth lumbar is deeply sunken in while the first sacral spine becomes proportionally prominent. Rigid bracing for a prolonged period may relieve some of the milder grades, but usually the best plan is the open operation by which the fifth lumbar is either grafted or fused on to the sacrum, permanently immobilizing the area of dislocation, Figure 354.

Posture.—As a consequence of poor muscular development, occupation, or

increasing disability on one or both sides and usually typically located in the sacro-iliac joint. Sometimes pressure over the joint through the anterior abdominal wall causes severe pain. The pain grows worse with much walking, or there is difficulty in rising from a chair; it is bad at night when some say they find a narrow pillow placed in the small of the back brings relief. There is difficulty in lacing shoes, or in picking up a pin, or in stepping high. The pain in front is mistaken for appendicitis, ureteral stone, or a stricture, and tubal or ovarian disease. The simple therapeutic test of a suitable binder holding the bones firmly in position is sometimes a necessary diagnostic aid. At night a buckskin belt is a valuable help.

Spondylolisthesis. — This far rarer condition consists in a slipping forward of the fifth lumbar vertebra until it projects and hangs

one of many other causes, a bad posture assumed habitually may involve the bones and ligaments until they gradually become conformed to the situation. The round-shoulder, hollow-back posture is the most frequent, in which the normal physiological curves of the spine are so exaggerated that the weight is transmitted through an utterly faulty mechanism. The muscles consequently are forced to support the spine at a great mechanical disadvantage, and over-

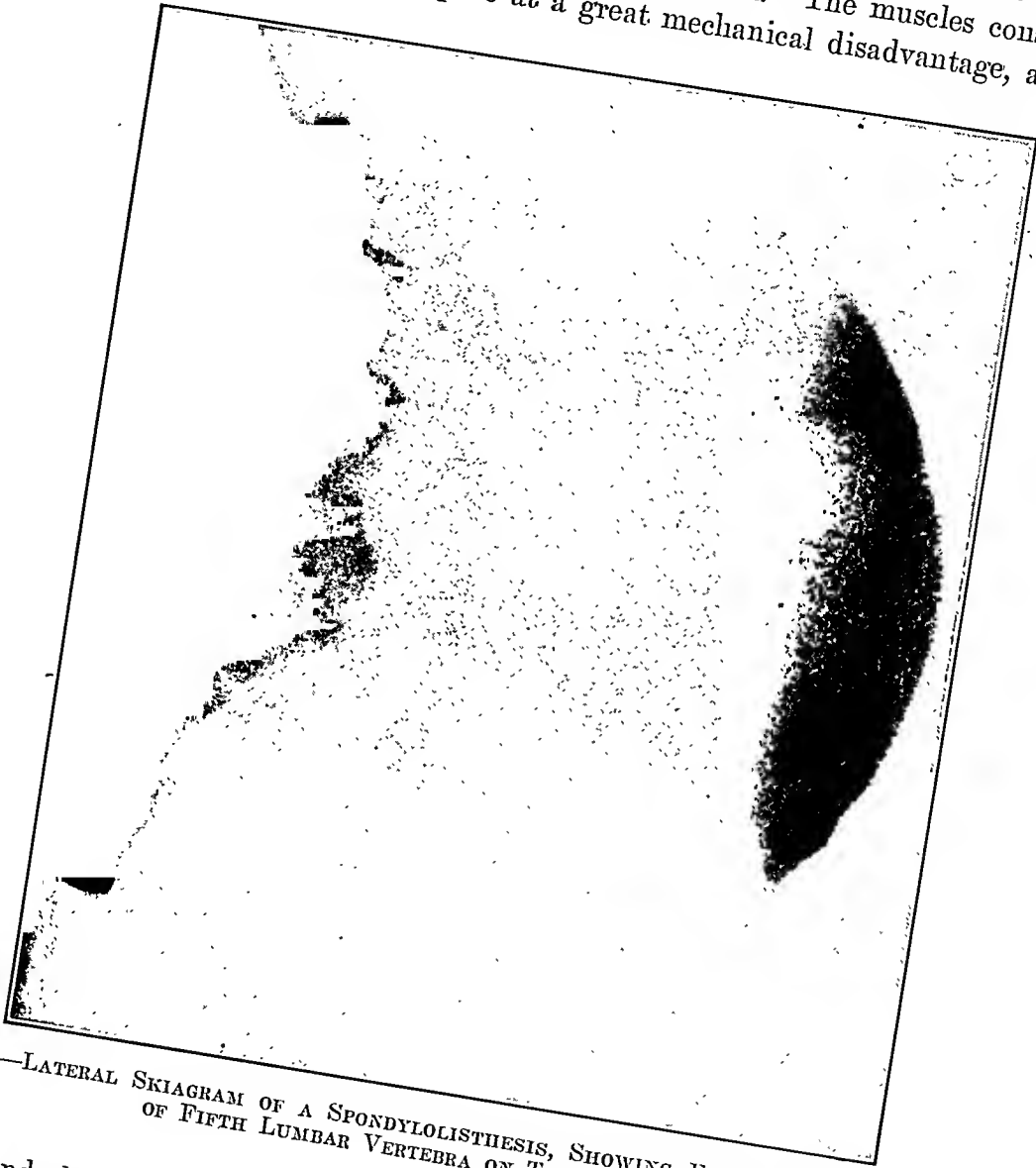


FIG. 353.—LATERAL SKIAGRAM OF A SPONDYLOLISTHESIS, SHOWING FORWARD DISPLACEMENT OF FIFTH LUMBAR VERTEBRA ON TOP OF SACRUM.

fatigue and chronic strain easily follow with resultant backaches. Any asymmetry of the pelvis from whatever cause, such as poliomyelitis, hip disease, congenital dislocation of the hip, inequality in length of legs, throws added strain on the muscles and ligaments and tends to bring about this postural type of backache. By no means infrequently even such an apparently remote condition as badly relaxed or strained flat-feet causes a faulty spinal posture and so becomes the efficient cause of a marked backache, especially in working

women constantly on their feet. This group is so large and diverse that a brief outline of diagnosis or treatment is impossible, and it is sufficient to emphasize the fact that it constitutes a distinct orthopedic problem and should be treated from that standpoint after all visceral and general constitutional factors are eliminated.



FIG. 354.—SPONDYLOLISTHESIS.

Case grafted later with relief. Note fourth and fifth lumbar vertebræ in abnormal relation to sacrum.

Pathological Conditions in Bones and Joints.—*Fractures.*—The body of a lumbar vertebra is often fractured by the indirect violence of a fall on buttocks or feet, a sort of fracture by contrecoup, which, since little or no obvious deformity results from the slight impaction, is easily overlooked. As a good

anteroposterior x-ray may reveal but little, a good lateral view is necessary. Root pains, local tenderness, and a slight prominence of one spinous process are suggestive of slight fracture, confirmed by the lateral plate. The treatment is conservative when seen early—a rest flat in bed on a frame for two months,



FIG. 355.—FRACTURE OF FIRST AND THIRD LUMBAR VERTEBRÆ.

Second lumbar was uninjured by fall crushing the two adjacent vertebræ.

followed by a plaster cast and supporting jacket for eight to twelve months. Old, untreated cases respond to operative fusion or grafting.

Occasionally one finds a fracture of a wing of the sacrum, the articular portion of the ilium, or the transverse processes of a lumbar vertebra. The history is that of severe trauma. The x-ray clears up the diagnosis, and the treatment is that of any other fracture in this region.

Tuberculosis.—Tuberculosis of the lumbar spine and sacrum involves the body of the vertebra with a gradual onset of symptoms—pain on standing or sitting and relief on lying down. Root pains, kyphosis,

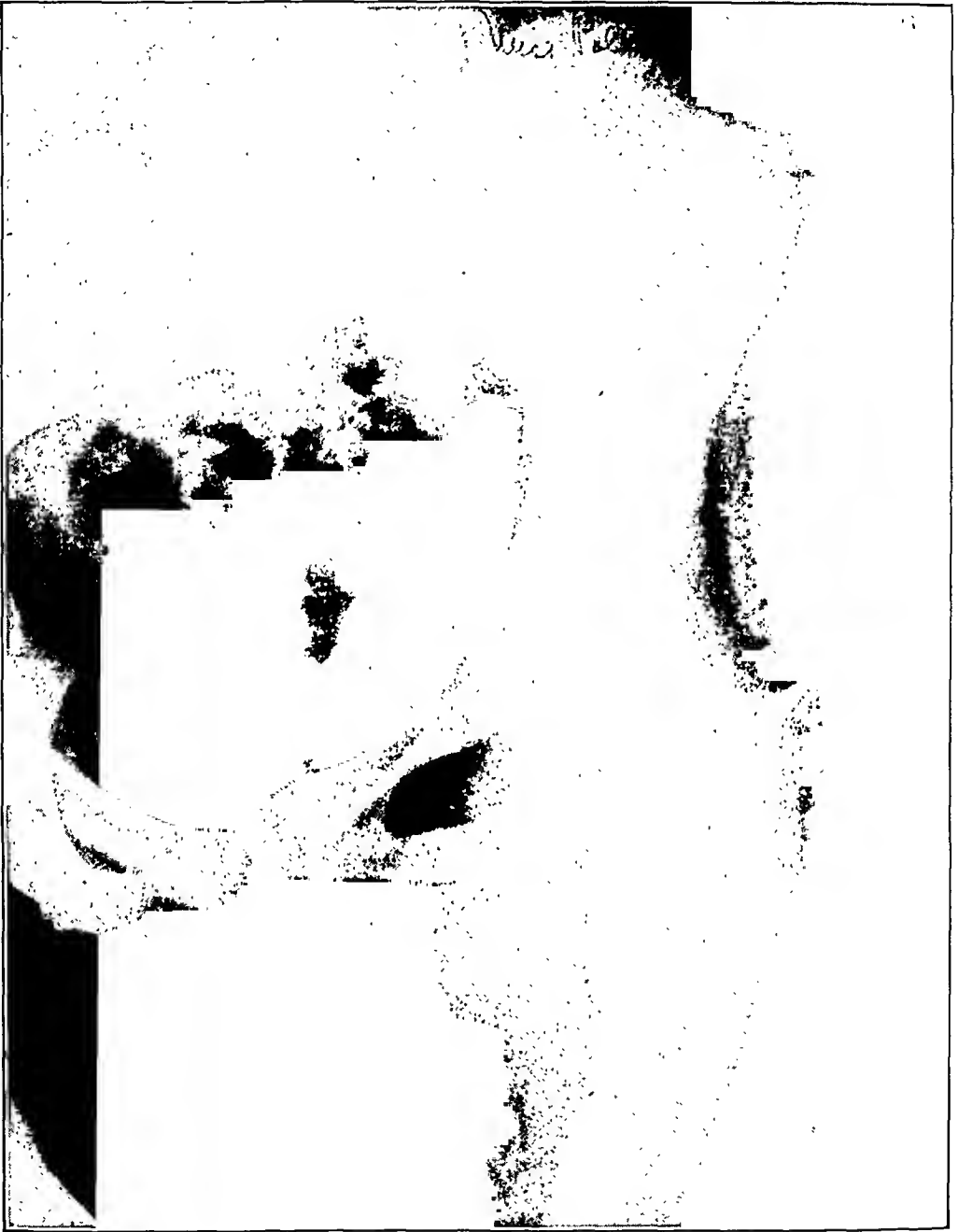


FIG. 356.—TUBERCULOSIS OF THE LEFT SACRO-ILIAC JOINT.

Note rarefaction and erosion, especially in lower part as compared to the normal right joint.

abscess formation, and other sequelæ appear late as the disease progresses. As an early diagnosis is of extreme importance in order that the disease may be arrested, this serious condition should be excluded in all doubtful cases by lateral x-rays which demonstrate the destructive lesion in its initial stages.

Treatment in adults should be radical barring contra-indications, such for example as an active pulmonary lesion. A bone-grafting or fusion operation shortens the disease by several years, by cutting down the period required to secure immobilization from three or four years to a few months.

Tuberculosis of the sacro-iliac joints is much less common than in the vertebræ and for this reason is often forgotten in making a differential diagnosis. The gradual onset is characterized by pain in the sacro-iliac joint with a frequent referred pain in the leg as in sacro-iliac strain. The localization is often in the anterior part of the joint, and the local signs need not be pronounced. The abscess is almost always anterior, simulating a pelvic or psoas abscess. The x-ray findings of destruction and haziness of the joint constitute our most definite early diagnostic data, Figure 356. The best treatment is an operative fusion or graft of the joint.

Arthritis.—This group is so protean in its origin and its symptoms that clear classification and succinct description are practically impossible. In general, we differentiate two main types.

The infectious showing proliferative and mildly inflammatory changes about the joint structures is due, we believe, to the action on the joints of irritative and destructive toxins manufactured in some distant focal infection. The incidence is at any time of life but is commonest between twenty and fifty. Any or all joints of the body may be affected; the intensity, duration, and extent of the changes vary extraordinarily. When the arthritis involves the lumbar spine or the sacro-iliacs, it manifests a variety of symptoms, chief among which is backache. The onset may be acute, giving rise to a "lumbago," or it is slow and chronic as in an atrophic arthritis deformans. The course may be steadily progressive or extremely intermittent, and many different joints are usually affected in the various onsets. The history of rheumatism or neuritis in other parts of the body is suggestive in the spinal type, as the back is usually not the sole site of activity but is commonly involved rather late. The pain is acute and localized or mild and diffuse. There are commonly signs and findings enough in the back to establish the diagnosis. The chief symptom is stiffness, especially on rising in the morning or after a rest period. Soreness and backache are worse at night. Referred pain from irritation of the nerve roots of the lumbar plexus as they emerge from the spine is frequent and "sciatica" is often a concomitant. On examination, the spine may be straight with the lumbar lordosis somewhat flattened out, or it may deviate in the direction of the most active arthritic changes. Muscle spasm with limitation of motion in all directions is marked; tenderness is often elicited on deep palpation of the articular and transverse processes. The sacro-iliac joint may be implicated also. X-rays of the lumbar spine show some delicate sharpening and spur formations about the edges of the vertebral bodies and articulations; the process, however, must be of some standing before definite x-ray changes are detectable, as they do not take place at the

outset but are like a slow stalactitic formation. Treatment is addressed primarily to clearing up all accessible foci of infection, followed by a general up-building, supporting corsets, massage, and baking to limber up the stiffened vertebral joints.

The changes in the hypertrophic or osteo-arthritis are primarily degenerative and represent an old age wear and tear process in which we readily recognize four predisposing factors: (1) Heredity: A family history of robust longevity and the rather plethoric body type with gouty or rheumatic complications later in life. (2) Age: An old age condition rarely seen before fifty years, commonest in the sixties. (3) Wear and tear: Personal activity and energy wearing the skeletal structures, often coupled with exposure. (4) Dietary habits: A type usually seen in the full-blooded who are good cooks and consumers of solid foods, especially starches, sweets, and red meats. The changes, really degenerative in character, have often progressed for years before the advent of the symptoms; one is frequently struck by the marked bony alterations in the spine when the first complaint is made. Being systemic in origin, such changes are not as a rule limited to any one joint, and we are aided in detecting a spinal osteo-arthritis by finding Heberden's nodes on the distal interphalangeal joints of the fingers and bony ridges about the condyles at the knee-joints. The actual spinal changes are a slight softening and flattening of the intervertebral articulations with large bony exostoses or spurs in the supporting ligamentous structures. The spurs limiting the mobility of the joints irritate the adjacent nerve roots and give rise to local soreness and stiffness with considerable referred pain along the course of the affected nerves.

The family and personal history, the age of the patient, the definite stiffness and limitation of motion in the lower spine, the osteo-arthritic changes in the more superficial joints, and the x-ray findings of large bony exostoses about the spinal joints are the decisive diagnostic factors. Treatment may be immobilization for extreme cases, but is as a rule limited to strong, supporting corsets, a firm bed, baking, light massage, and dietary restrictions especially reduction of carbohydrates, acid foods, and red meats. Atophan or colchicum in fairly large doses mitigates symptoms.

The combination of back strain in either type of arthritis is common, producing a condition more difficult to relieve and calling for prolonged and rigid support and all other physiotherapeutic adjuncts.

Metastatic Lesions.—Metastases from breast, thyroid, and hypernephroma, and sometimes from cancer of the body of the uterus are common in the spine and in the pelvic bones. Primary myelomata and sarcomata are also not extremely rare. The diagnosis of such a malignant metastasis depends upon a history of a primary tumor, local tenderness, extreme pain especially at night, marked disability, muscle spasm, and the x-ray revelation of a destructive lesion particularly in the body of the vertebra on a lateral examination.

In an early metastasis the pain may be excruciating without any physical findings, making the diagnosis necessarily symptomatic but in a high degree probable.

Other Causes.—Among the rarer causes of backache are metabolic and degenerative changes in the bone due to osteomalacia, Paget's disease, etc., which demand mention if not discussion.

Neurological Conditions.—Among the neurological causes of backache may be mentioned spinal cord tumor, chronic spinal meningitis such as that following lumbar puncture and other organic lesions, and a large group with a neurasthenic or a pure neurotic basis either accounting for the whole complaint or at least for the exaggeration and protraction of symptoms arising from some trifling injury. The somewhat puzzling group labeled coccygodynia probably falls largely into this last category.

It thus seems clear that the region of the lower back and pelvis, the site of so much distress from "backache," is in reality an advantageous rendezvous for gynecologist, orthopedist, neurologist, internist, and even psychiatrist, one or all aiding and supplementing one another in the effort to untangle a symptom-complex which may objectively reveal a uterine displacement, abscessed teeth, bone tuberculosis, developmental anomaly, spinal cord lesion, a pure neurosis, or one of a variety of associated or intermediate conditions.

CHAPTER XXVII

THE VERMIFORM APPENDIX IN GYNECOLOGY

RICHARD W. TELINDE

RELATIONSHIP BETWEEN DISEASES OF APPENDIX AND PELVIC ORGANS

Disease of Appendix Primary and Pelvic Affection Secondary

Pelvic Affection Primary and Disease of Appendix Secondary

Independent Affections of Pelvic Organs and of Appendix

DIFFERENTIAL DIAGNOSIS BETWEEN ACUTE APPENDICITIS AND GYNECOLOGICAL CONDITIONS

Acute Gonococcal Salpingitis

Postpartum or Postabortal Infection

Acute Pyelitis or Ureteral Stone

Ectopic Pregnancy with Rupture or Tubal Abortion

Ovarian Cyst with a Twisted Pedicle

Ruptured Corpus luteum or Graafian Follicle Hematoma

DIFFERENTIAL DIAGNOSIS BETWEEN CHRONIC APPENDICITIS AND GYNECOLOGICAL CONDITIONS

Chronic Salpingitis

Ureteral Stone or Stricture, with or without Pyelitis

Ovarian or Uterine Tumors

TREATMENT

APPENDICITIS IN PREGNANCY

Relationship between Diseases of Appendix and Pelvic Organs.—By reason of their proximity, the appendix and the pelvic organs are frequently associated in disease and the symptoms often become confusing. A relationship between diseases of the appendix and the pelvic organs may be accidental or causal; the most obvious classification, therefore, is:

Diseases of Appendix Primary and Pelvic Affection Secondary or Consequent on Appendical Lesion.—This is much less common than the reverse and yet one not infrequently sees the tube and ovary on the right side involved in an inflammatory process obviously appendical in origin. Extensive inflammatory involvement of the pelvic organs due to appendical disease is seen less often to-day than formerly as fewer appendices advance to abscess formation or extensive peritonitis. The pelvic adhesions resulting from appendical inflammation may occlude the lumina of the tubes and cause sterility, or, the uterus may be drawn back into retroposition by peritoneal adhesions originating in the appendix.

Pelvic Affection (Tubal, Uterine, or Ovarian) Primary and Disease of Appendix Secondary.—The involvement of the appendix in an inflammatory process primary in the tubes is a familiar sight to the operator, and to the gynecological pathologist one of the commoner lesions seen is periappendicitis



FIG. 357.—TUBO-OVARIAN ABSCESS. PERIAPPENDICITIS.

Appendix adherent from root to tip, distal portion following dotted line lies upon pelvic floor under tubo-ovarian abscess. Douglas's pouch is obliterated. (Kelly and Hurdon, *Vermiform Appendix*, W. B. Saunders Co.)

obviously secondary to grossly diseased tubes lodged near the appendix, Figure 357.

An appendix covered with tubercles is also often seen, associated with primary tubal tuberculosis. Not infrequently an appendix is found adherent to a uterine or ovarian tumor, Figure 358, particularly a dermoid cyst, Figure 359.

The association of pelvic organs and appendix is well illustrated in pseudo-

myxoma peritonei following the escape of gelatinous material from a primary ovarian tumor which envelops as well as distends the appendix.

Independent Affections of Pelvic Organs and of Appendix.—On operation for an acute appendicitis, an old salpingitis is often seen, or, in removing pus-tubes of not long standing, old adhesions are found involving the cecum and appendix. The combination of an ectopic pregnancy and an acute appendicitis is not rare.

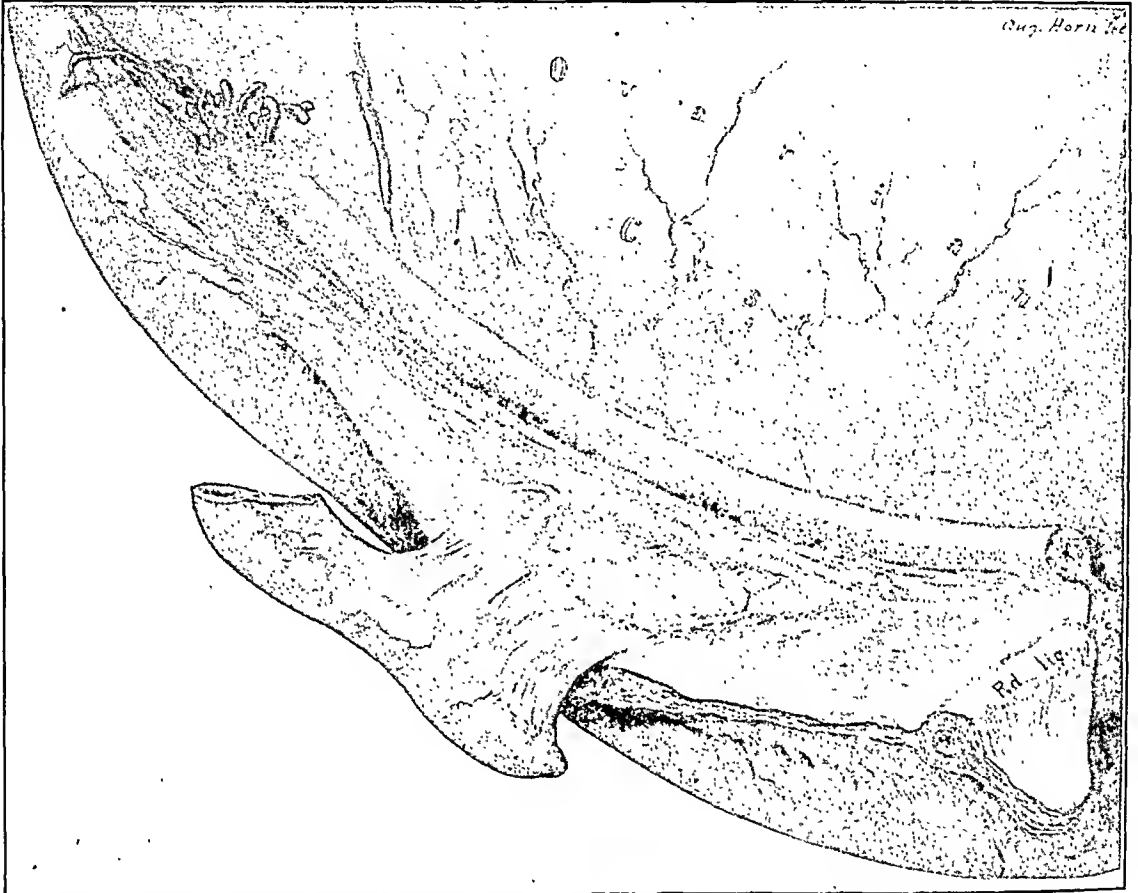


FIG. 358.—DISTAL PORTION OF APPENDIX ADHERENT TO BROAD LIGAMENT IN CASE OF LARGE MULTILOCULAR OVARIAN CYST.

Recovery. (Kelly and Hurdon, *Vermiform Appendix*, W. B. Saunders Co.) $\times 1$.

Differential Diagnosis between Acute Appendicitis and Gynecological Conditions.—It is often difficult to distinguish these two morbid conditions of adjacent organs, while the importance of making the distinction is well illustrated by an acute gonococcal salpingitis where delay is advisable and an acute appendix where delay may readily prove fatal. Also, an accurate pre-operative diagnosis determines the site of the incision.

Acute Gonococcal Salpingitis.—The differential diagnosis rests upon history, physical findings, and the course of the disease. A history of exposure may be significant. A recent vaginal discharge is some evidence for salpingitis; frequency and burning of urination are suggestive. These may be the pro-

dromata of the abdominal symptoms. Gastro-intestinal symptoms are more suggestive of an inflamed appendix. A history of previous attacks of right iliac fossa pain associated with nausea and vomiting is significant. Acute salpingitis may be associated with gastro-intestinal symptoms, but the absence of vomiting, or at least nausea, should make one hesitant in diagnosing appendicitis. The pain in salpingitis is generally bilateral but may be much more

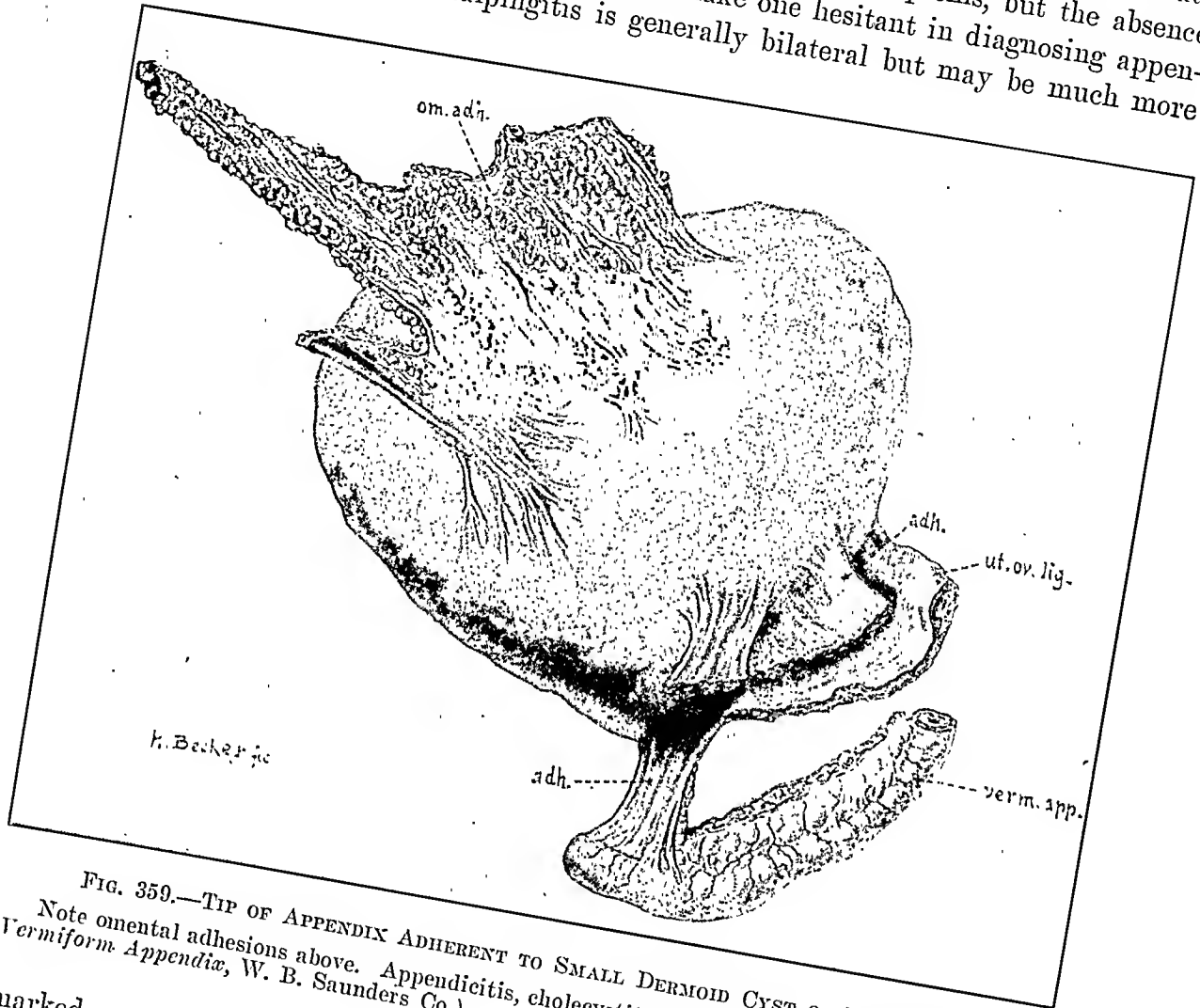


FIG. 359.—TIP OF APPENDIX ADHERENT TO SMALL DERMOID CYST OF LEFT SIDE.
Note omental adhesions above. Appendicitis, cholecystitis. Recovery. (Kelly and Hurdon, *Vermiform Appendix*, W. B. Saunders Co.)

marked on one side or even wholly unilateral; it is usually dull, aching, and throbbing, deep in the pelvis. In appendicitis, the typical pain starts in the epigastrium and then becomes localized in the fossa but varies more or less with the disposition of the appendix and becomes more puzzling when it hangs down in the pelvis. A bimanual examination under anesthesia will at times differentiate nicely between the two. The appendical pain is also apt to be paroxysmal and cramplike.

Fever and leukocyte count usually offer but little in the differentiation. However, if the leukocyte count is disproportionate to the temperature, it points rather to appendicitis than to salpingitis. The location of the point of maxi-

maximum tenderness is significant: In typical appendicitis, it is at McBurney's point; in salpingitis, usually lower and more over the true pelvis or just above Poupart's ligament. The muscle spasm in early acute appendicitis is apt to be confined to the right rectus, maximum at the point of greatest tenderness. In acute salpingitis, it is less marked, lower down, and apt to be bilateral. A patient with acute salpingitis does not lie with the right thigh flexed, so common in appendicitis. A walled-off appendical abscess can usually be felt above in the right iliac fossa, but a tubo-ovarian abscess, unless it is a very large one, is not usually palpable above. If it can be felt, it is just above Poupart's ligament. A salpingitis peritonitis is usually lower abdominal, while that secondary to appendicitis is more apt to become generalized.

A pelvic examination is most important in the differentiation. An intact hymen is strong evidence, of course, against gonococcal salpingitis. If there is a discharge, a smear may reveal gonococci. The pelvis is usually tender on both sides at the vaginal vault in salpingitis, and pain is caused by pressing up or moving the uterus. Induration at the vault is also determinative.

Postpartum or Postabortal Infection.—This type of infection may create a picture simulating an acute appendicitis. A careful history ought to lead to a correct diagnosis. A recent delivery of a full-term child or an abortion, particularly with criminal interference, creates a presumption in favor of postpartum infection. The fever is apt to be high and of a septic type, with a proportionately high leukocyte count. Chills are more frequent than in appendicitis. Pain as a rule is less marked, but the prostration is greater. Abdominal examination reveals a generalized lower abdominal tenderness becoming maximum in a direction downward. Muscle spasm varies with the extent of the peritonitis and is apt to be bilateral. Any broad ligament abscess formation is apt to point above Poupart's ligament. A vaginal examination may show recent lacerations or abrasions, a profuse discharge, a softened cervix, an enlarged and softened uterus, and tenderness in the broad ligament region with induration and possibly abscess formation.

Acute Pyelitis or Ureteral Stone.—In investigating the source of a pain localized in the right tubo-ovarian and appendical region, perhaps accompanied by fever, one must not forget that an acute pyelitis or ureteral stone, particularly when lodged at the pelvic brim, sometimes gives rise to symptoms which have not only been mistaken for appendicitis or tubal infection but have even led to operation in a number of instances (*vide* G. L. Hunner).

Routine, careful examination of the urine should always put the surgeon on his guard and avoid this error.

Ectopic Pregnancy with Rupture or Tubal Abortion.—This condition is sometimes confused with acute appendicitis especially by our general surgeons, although the best diagnosticians have erred at one time or another. A tubal abortion so mistaken is always atypical, lacking the classical symptoms. The most that can be gathered may be severe pains at intervals, some anemia, and

pelvic tenderness on one side; then, perhaps, on careful questioning, a delayed or missed period and some bloody vaginal discharge. There may also be a boggy mass of clots posteriorly on the right. The history is so different from an active appendix that suspicion should be aroused at once.

Ovarian Cyst with a Twisted Pedicle.—There is a history of the sudden onset of severe pain with nausea and vomiting suggestive of appendicitis. The onset, however, is more acute, and syncope from excruciating pain is not infrequent. Abdominal palpation or a bimanual examination (gas anesthesia if necessary) must reveal a well-defined cystic tumor. Dermoid cysts are oftenest subject to torsion, infection, and peritonitis; here the differentiation is most difficult.

Ruptured Corpus luteum or Graafian Follicle Hematoma.—This condition, although rare, is easily confused with appendicitis. At operation a bleeding point is found in the ovary, either at the site of a corpus luteum or graafian follicle. The quantity of blood free in the peritoneal cavity is usually small, although TeLinde has seen as much as 300 c.c. The temperature and leukocyte count, from the absorption of blood, may exactly simulate acute appendicitis. The chief points of differentiation are the lesser degree of muscle spasm and the lower point of maximum tenderness in the abdomen. The menstrual history as a rule does not assist. If in an appendix operation, the organ is found normal with little free blood in the peritoneal cavity, the ovaries should be carefully inspected for this condition.

Differential Diagnosis between Chronic Appendicitis and Gynecological Conditions.—*Chronic Salpingitis.*—The differentiation may be obvious, but when the salpingitis is mild and the tubal changes are so slight that the bimanual findings are doubtful, a careful anamnesis is of great value. The occurrence of gastro-intestinal symptoms—flatulence, nausea, and vomiting, with aggravated pain—favors appendical inflammation. Most gynecologists recognize a right-sided dysmenorrhea due to a chronically inflamed appendix. A dull aching pain deep in the pelvis and in the back and irregularity in menses speak for salpingitis. The usual deviation is an increase in frequency and often profuse periods. The history of bladder irritability and leukorrhea acquired at or shortly before the onset of the pelvic pain is strong evidence for salpingitis. Pelvic examination in chronic salpingitis may reveal a gonococcal infection. With definite induration or enlargement of the adnexa the diagnosis is simple, but in the milder cases the pelvic findings remain doubtful. Here an examination under anesthesia is a great help, revealing slight but definite changes. The Rubin test helps in deciding the patency of the tubes. In several instances we have found occluded tubes by this test and made a midline instead of a lateral incision to discover tubes not sufficiently enlarged to be felt and yet definitely diseased.

Ureteral Stone or Stricture, with or without Pyelitis.—Hunner emphasizes the importance of eliciting tenderness on pressure at the point where the ureter

passes over the pelvic brim (Morris's point, $1\frac{1}{2}$ inches from the umbilicus on a line connecting the umbilicus with the anterior superior spine) in ureteral conditions, as contrasted with the tenderness at McBurney's point in an appendicitis. He also points out the frequency of an associated tenderness on vaginal pressure at the lower end of the ureter. It is always important to exclude

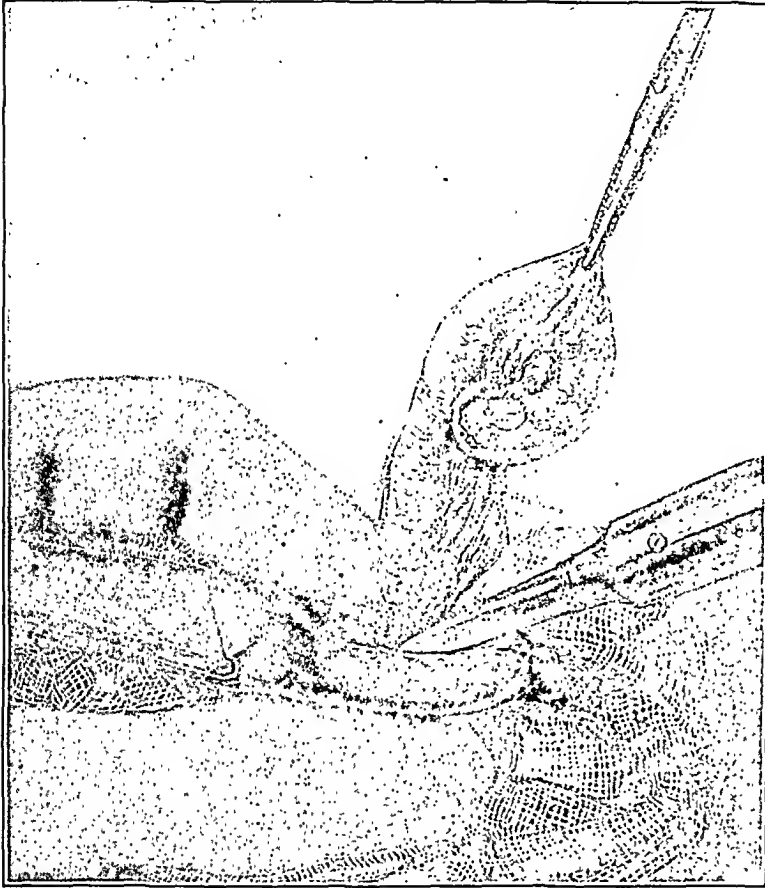


FIG. 360.—FIRST STEP.

Mesappendix ligated and divided. Circular or mattress suture placed ready to turn in stump. Appendix then crushed near its base with powerful grooved forceps and held away from cecum by wet gauze. It is then slowly amputated with cautery. (Kelly and Hurdon, *Vermiform Appendix*, W. B. Saunders Co.)

Treatment.—The diagnosis of appendicitis indicates operation sooner or later. If there is but little doubt as to the diagnosis, a muscle-splitting McBurney incision is made. When gall-bladder or other right-sided exploration is desirable, a right rectus incision is best, enlarged as necessary. With a combined pelvic condition, the infra-umbilical midline incision is preferable. The technique of appendectomy is represented in Figures 360, 361, and 362.

The cecum and appendix are delivered and the wound and intestines protected with moist gauze. The meso-appendix is controlled with one or more plain catgut ligatures and divided down to the base. A purse-string suture

disease of the urinary tract before doing an appendectomy. A catheterized specimen of urine alone is dependable and even though this proves negative, if there is any lingering doubt, a complete urological investigation should follow, including, when feasible and seemingly advisable, ureteral catheterization with a wax tip and bulb, a differential phthalein, and a pyeloureterogram.

Ovarian or Uterine Tumors. — These may give rise to right lower quadrant pains suggestive of a diseased appendix. The abdominal and pelvic examinations usually make the diagnosis obvious.

of medium black silk or Pagenstecher is laid around the base of the appendix. The appendix is crushed about a half centimeter from its base, cauterized, and sterilized. The stump is then inverted and the purse string drawn up and tied and reinforced with a mattress-suture of fine black silk, and the cut surface of the meso-appendix either drawn up to it or buried with a continuous suture of fine black silk.

In case the carbolic and alcohol technique is used, it is customary to reflect a cuff of peritoneum about one-half a centimeter from the appendix base. The appendix is crushed at this point with a clamp and ligated with plain catgut, clamped just distal to the free tie, and amputated with the scalpel between the clamp and the ligature. The stump is cauterized with the tip of a clamp dipped in carbolic and wiped with a bit of gauze dipped in alcohol; it is then inverted as above.

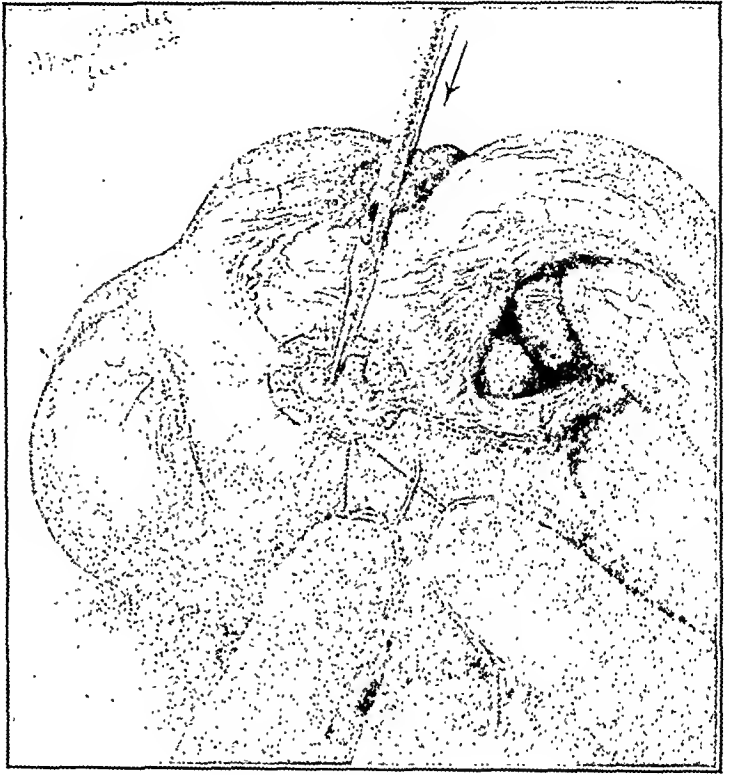


FIG. 361.—SECOND STEP.

Little translucent stump then invaginated into cecum by circular suture. (Kelly and Hurdon, *Vermiform Appendix*, W. B. Saunders Co.)

A helpful point in technique in removal of a retrocecal appendix is its exposure by Cullen's method. "In nearly every case the base of the appendix can be located by following the longitudinal band on the cecum. When once this is located, a Kelly blunt forceps is pushed through the meso-appendix at this point and grasps a piece of tape. . . . The two ends of the tape are then grasped in the tip of the forceps and used as a tractor. Strong traction is exerted without any injury either to the cecum or to the appendix. The traction invariably brings up from three quarters to an inch of the appendix. Another forceps is passed through the meso-appendix and grasps a second piece of the tape. . . . The second tape is now used as a tractor and a further portion of the appendix exposed. A third forceps is pushed through the meso-appendix and a loop of the tape passed around the appendix. . . . Traction on this third loop will usually expose the tip of the appendix" (W. Neill, Jr.). After this delivery, the removal follows the usual technique.

What to do with the appendix in operations primarily for gynecological

conditions deserves particular consideration. I advocate its routine removal in pelvic operations provided the condition of the patient is satisfactory. That this can be done without risk has been demonstrated by many years of experience at the Johns Hopkins Hospital. The gynecologist sometimes finds an appendix intimately bound up with a tubo-ovarian inflammatory mass or a



FIG. 362.—THIRD STEP

Operation completed. (Kelly and Hurdon, *Vermiform Appendix*, W. B. Saunders Co.)

pelvic tumor and so anchored at its two ends; it is then well first to amputate it at its base, releasing one end and removing it with the mass. When the abdomen has been opened in a midline incision and an appendix abscess is found, it is wiser to cut down to the abscess through an additional lateral incision, guided by an intra-abdominal hand, and then to close the midline incision, and finally to open the abscess. An appendix abscess may gravitate in to the culdesac, when it is best drained through the posterior vaginal fornix.

Appendicitis in Pregnancy.—Acute appendicitis occurs in pregnancy with probably an average frequency, both conditions being common incidents. It is generally agreed, however, that the pregnant state does greatly aggravate the dangers, the inflammation being more stormy and gangrene and perforation setting in more rapidly, with less likelihood of enveloping protective adhesions, all enhancing the risks of a virulent peritonitis. There is also grave danger of miscarriage, particularly in the later months, with serious complications arising through the appendix. The increased difficulty in arriving at a correct diagnosis and the natural hesitation with its consequent procrastination conspire to higher mortality.

A typical attack of appendicitis begins with sudden, severe, abdominal pain, soon localized in the right fossa and associated with tenderness, muscle rigidity, and constitutional symptoms generally recognizable without difficulty; if the pain and tenderness are not well localized, and the constitutional symptoms are slight, the pains, especially in a primipara, are likely to be mistaken for a threatened miscarriage. In the early months of pregnancy, the differential diagnosis between an intra-uterine pregnancy complicated by appendicitis and an extra-uterine gestation may be perplexing and call for a most careful history and physical examination. The differential diagnosis of ap-

pendicitis from other conditions accompanying pregnancy, especially pyelitis, is based upon the same characteristic features as in the nonpregnant state.

Once diagnosed, the operation must be immediate. The earlier in the course of pregnancy, the lower the mortality and the less likely an abortion. An operation early in pregnancy also obviates the grave danger of a second attack. The McBurney incision is preferred, enlarged if necessary by dividing the aponeurosis and muscles. It is well to perform the operation with as little trauma and as little loss of time as possible and to avoid handling the uterus to minimize the chance of abortion. Following the operation, substantial doses of morphin should be given to keep the uterine musculature at rest.

CHAPTER XXVIII

RETRODISPLACEMENT AND SUSPENSION OF UTERUS SUSPENSION OF PROLAPSED OVARY

HOWARD A. KELLY

RETRODISPLACEMENT AND SUSPENSION OF UTERUS SUSPENSION OF PROLAPSED OVARY

RETRODISPLACEMENT AND SUSPENSION OF UTERUS

One of the commonest gynecologic conditions is uterine retrodisplacement, whether a version or a more or less sharp angulation and flexion backward, which may or may not give rise to symptoms sufficient to call for correction. This retrodisplacement is also important as it looms up large in the minds of many women as well as of our general practitioners, still lingering as the one plausible explanation of a woman's backache, dysmenorrhea, constipation, and general malaise.

A retroversion in which the uterus though still slightly inclined on its own long axis in an angle of moderate forward flexion is, however, tilted over in its horizontal axis until it reclines in the sacral hollow as in a rocking-chair, in an anteversion-retroposition, is not pathologically important nor does it give rise to symptoms calling for therapeutic efforts. I speak here also of those retroflexions in which the body of the uterus is angled backward on its cervix, as often found in nulliparous women where it is usually a developmental condition giving rise to no symptoms likely to be relieved by the correction of the displacement. Another group, occurring in parous women, is apt to be associated with more or less broken down internal supports as well as the loss of efficient support at or near the vaginal outlet.

Not wholly to neglect the first group occurring in nulliparæ, in the endeavor to decide whether a dysmenorrhea and distressing bearing down feelings are likely to be relieved by a surgical permanent replacement of the uterus in anteversion, one can often test the matter and arrive at a decision by inserting a good supporting pessary which tends to hold the uterus up or by using a vaginal pack for a time to keep the uterus from sagging. If great relief follows, it will be well to proceed with the correction; one must not, however, omit to allow for the psychological effect of expectation and of the local treatment. It must also be remembered that backache and constipation are almost never causally connected with a retrodisplacement *per se*.

In an early study of 182, Gerry Holden found that 60 per cent were entirely or greatly relieved by operation. I believe to-day with greater care in selection, the percentage of relief is larger.

The Alexander operation, suspending the uterus by its round ligaments hauled taut and sewed fast in the inguinal canals, has pretty generally been abandoned for a direct operation via an abdominal incision which offers the important opportunities of a better mechanical advantage and at the same time of an inspection of the pelvic organs and the vermiform appendix and if need be the gall-bladder—addenda not infrequently revelatory.

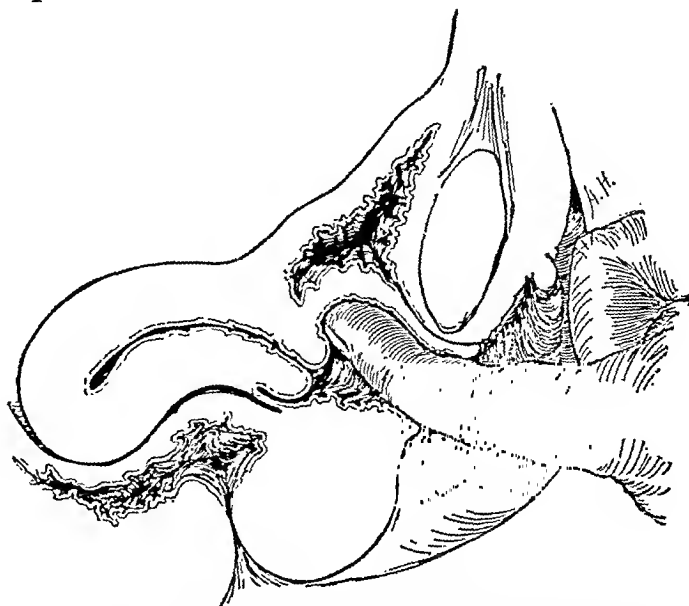


FIG. 363.—NATURAL RETROFLEXION WHICH CANNOT BE CORRECTED ON ACCOUNT OF ABDOMINALLY SHORT VAGINA.

Although anterior fornix can be pushed up and lengthened, it is not much longer than first joint of finger.

The original operation of 1886 by the direct suspension of the fundus by

sutures to the abdominal wall was abandoned in the child-bearing period, owing to the complications occasionally arising in pregnancy, and because of the rare strangulation of the small bowel under the strong suspensory ligament.

Since those first operations about forty years ago, a hundred different procedures, devised to correct a retrodisplacement, form one of the curiosities of surgical literature. In determining what to do, several things must be considered:

(1) That the operation shall

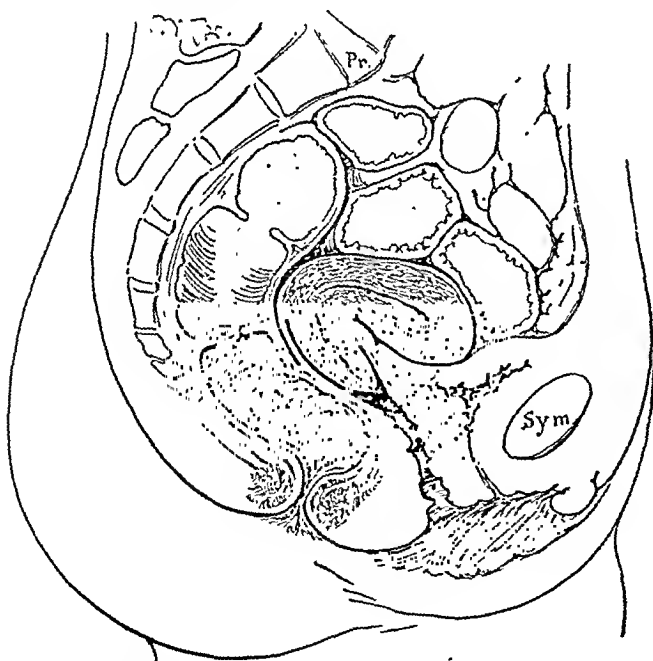


FIG. 364.—ACUTE ANTEFLEXION OF UTERUS WITH CONICAL CERVIX TENDING TO BECOME TAPIROID.

not entail any risk immediate or remote; (2) that it shall be permanently effective; (3) that when the inferior pelvic supports are also deficient, the

whole burden of maintaining its position must not be thrown on the body of the uterus.

I describe two procedures: An operation I have long used suspends the uterus by transfixing the deep fascia of the abdominal wall on each side with a nonabsorbable suture, catching up the round ligament near the uterus and then passing back through the abdominal wall close to the point of entrance

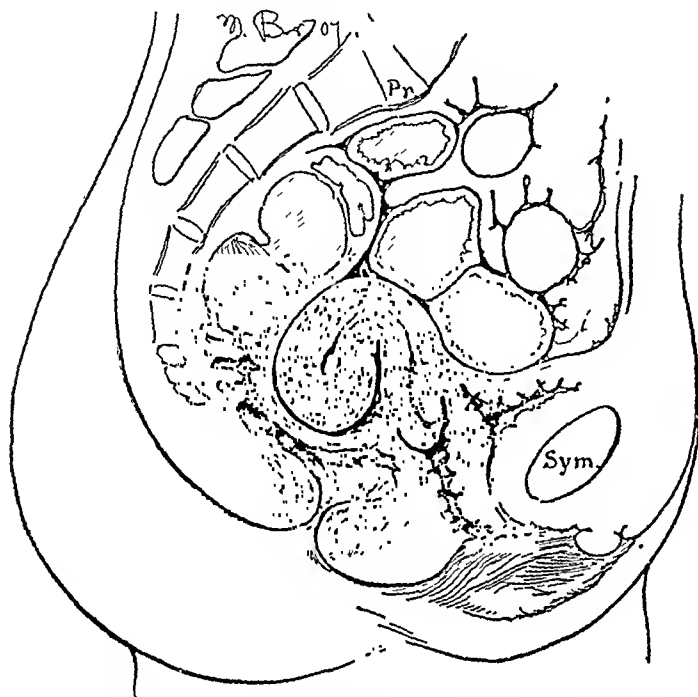


FIG. 365.—ACUTE RETROFLEXION OF UTERUS SOMETIMES CAUSE OF STERILITY BUT MORE OFTEN OF ABORTION IN EARLY MONTHS.

when it is pulled taut and tied on both sides, holding the uterus snugly forward. The other is the Gilliam operation or one of its modifications by Simpson and Cullen, by which the round ligament doubled on itself is drawn through a hole in the anterior wall low down and fastened to the rectus fascia on both sides.

In the first procedure, the bladder being empty, a low abdominal incision is made about 8 centimeters long down to the linea alba. The fat is freed from the rectus fascia on both sides of the lower end of the inci-

sion. The abdomen is then opened and round ligaments caught about 2 centimeters from their uterine insertions with an Allis forceps. A strong but not too stout silk or linen suture is now passed with a long curved needle on both sides through the abdominal wall under the fat layer, piercing the fascia, tendon, and peritoneum. A finer needle picks up the peritoneum at frequent intervals, skirt-ing below the rim of the pelvis around to and embracing the round ligament as far as the Allis forceps where it transfixes the ligament and is then at once passed through the abdominal wall and brought out near the starting point. The opposite side is treated in the same way and both sutures pulled up, drawing the uterus forward until it touches the symphysis. Then the operator, assured that there is no hole left on either side to trap a loop of bowel, ties both suspensory sutures. The permanence of this procedure depends upon the durability of the two suspensory sutures.

It appeared for a time, in the beginning of our suspensory work, as though it might prove a great boon to shorten uterosacral ligaments at the same time, thus pulling the lower uterine pole up and back while the fundal anterior pole was drawn forward and securing a maximum mechanical advantage. I found

Max Sänger of Leipzig working over this end of the problem in the late eighties and our own J. Wesley Bovee later gave it his careful consideration. George Gray Ward feels that it is a distinct adjuvant not to be neglected in the occasional case.

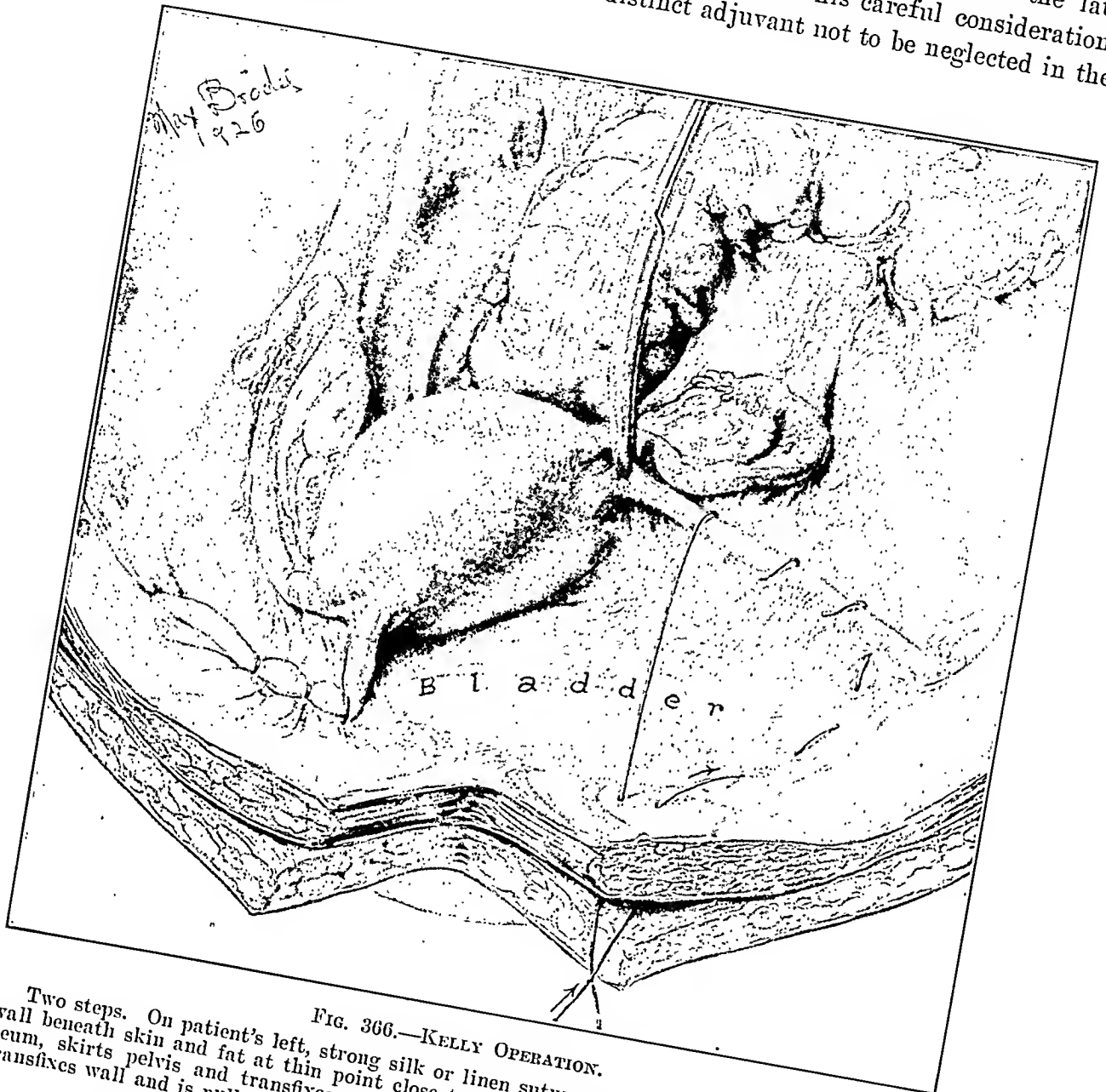


FIG. 366.—KELLY OPERATION.

Two steps. On patient's left, strong silk or linen suture transfixes thickness of abdominal wall beneath skin and fat at thin point close to rectus attachment; then, picking up peritoneum, skirts pelvis and transfixes round ligament at two or more points when it again transfixes wall and is pulled up snugly and tied as shown on right side.

In Simpson's modification of the Gilliam operation, a median abdominal incision $1\frac{1}{2}$ to 3 inches long is made just above the symphysis; a round ligament is grasped by a delicate forceps an inch from its uterine attachment and drawn up, when a silk suture is passed to encircle about three-fourths of the ligament at this point; the needle is then taken off and both ends of the suture passed through the eye of a carrier; the peritoneum is incised just

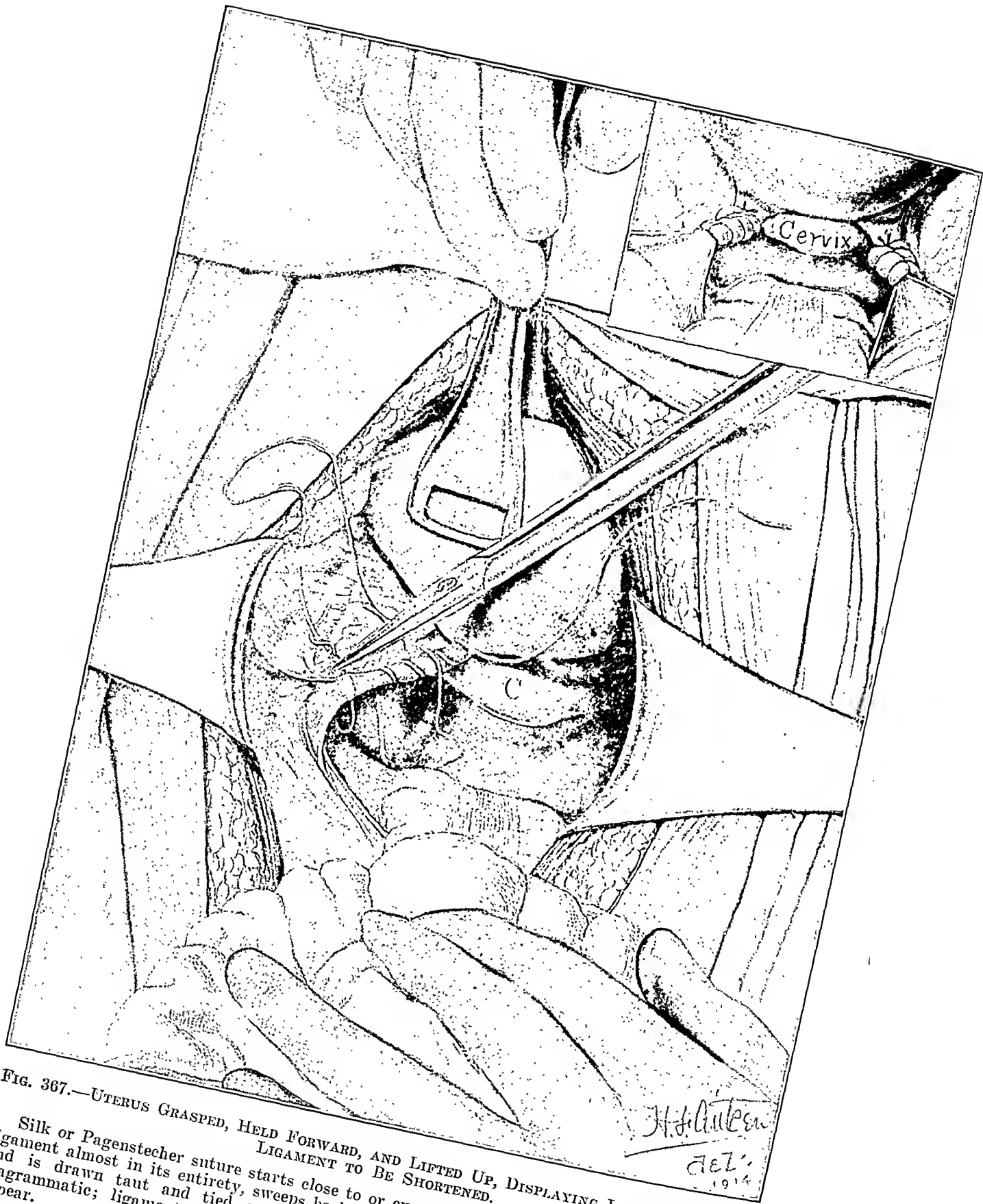


FIG. 367.—UTERUS GRASPED, HELD FORWARD, AND LIFTED UP, DISPLAYING LEFT UTEROSACRAL LIGAMENT TO BE SHORTENED.

Silk or Pagenstecher suture starts close to or even a little in cervix and, taking up round ligament almost in its entirety, sweeps back to pelvic wall where it may be caught in fascia and is drawn taut and tied as shown in inset, right upper angle. Figure is rather diagrammatic; ligament is not so sharply marked posteriorly nor strangulated as would appear.

below and in front of the round ligament, and the carrier pushed in and passed directly forward, immediately beneath the peritoneum of the vesico-uterine pouch, to a point on the anterior abdominal wall just above Poupart's ligament

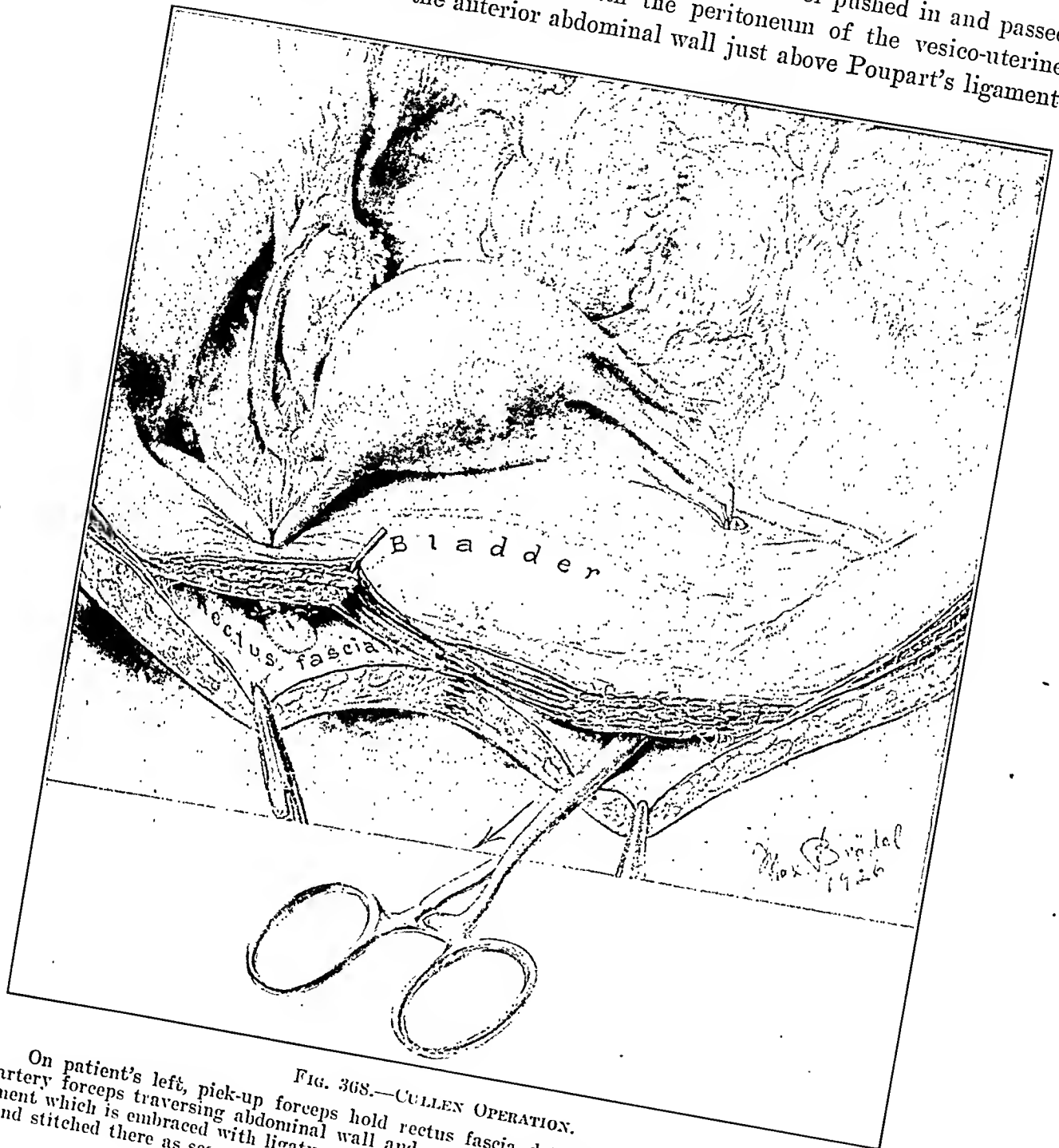


FIG. 368.—CULLEN OPERATION.

On patient's left, pick-up forceps hold rectus fascia detached from rectus muscle, while artery forceps traversing abdominal wall and peritoneum appear near middle of round ligament which is embraced with ligature and drawn through wall to position under rectus fascia and stitched there as seen on right side. Representing completed operation.

and an inch and a half from the median line where it emerges; both ends of the suture are grasped and the carrier withdrawn; one end of the suture is now threaded on a sharply curved needle which is passed into the abdominal

wall, grasping peritoneum, muscle, and fascia, and again emerging into the cavity. When both sides are treated in this way, the sutures are tied, drawing the uterus well forward.

T. S. Cullen's procedure is readily appreciated on examining Figure 368.

SUSPENSION OF PROLAPSED OVARY

Prolapse of the ovary is a comparatively common disorder and an indisputable cause of serious discomforts and even acute suffering. It has long since been recognized as a malady and dealt with by our predecessors who discovered the tender organ dropped into the culdesac behind the cervix and on pressure elicited a complaint of a typical more or less severe pain. In many women, the displaced ovary is merely an incidental discovery and is not sensitive and occasions no disturbance of health.

Among the earlier writers dealing with this subject in America were Storer, Skene, Mundé, Goldspohn, and Hirst.

We feel to-day that too much attention was formerly paid to the displacement *per se*, followed by long courses of ineffectual treatments, the subject occupying somewhat the same relative position as laceration of the cervix in the late eighties, but in the latter case there remains a residuum needing surgical care.

Ovarian displacement is a common concomitant of uterine retrodisplacement, where, instead of the more obvious uterus, the enlarged and tender ovary is sometimes the real source of the pelvic distress relieved by the corrective operation.

Treatment of this condition has been studied by George Gray Ward (*J. Am. M. Ass.*, Nov. 2, 1907).

A characteristic symptom is a localized pelvic pain increased by the congestion of menstruation and by walking or standing. The internal pain is often so severe as to prohibit coitus. Defecation with constipation often gives rise to pain at times agonizing, accompanied by collapse, profuse perspiration, and nausea, persisting after the end of the function (Ward). Mundé laid to its credit epilepsy and hysteria; dysmenorrhea is a concomitant as well as paroxysms of intermenstrual pain.

Diagnosis is made on discovery of the rounded, sometimes slightly nodular, displaceable, painful ovary hanging low down near the vaginal vault. Bimanually and through the rectum it is easily outlined in the culdesac or hanging lateral to the cervix. The ovary may be enlarged and its capsule irregular and thickened and attached or bound down by adhesions more or less dense, and the retroflexed ovary with the displaced uterus interferes seriously with the ovarian circulation. Such a displacement should be looked for when the ovarian veins are found unusually dilated.

Surgical treatment was first discussed seriously in 1886 by F. Imlach of Liverpool, a pupil of L. Tait, who suggested attaching the ovary in a conceivably normal position by suture and called his operation oöphorrhaphy. Since then, as in suspension of the uterus, numerous and varied are the operations proposed.

When a retrodisplaced uterus is brought into an anteposture as described, the ovary is often lifted from the floor out of the lower pelvis, with relief of all symptoms. Again, I have repeatedly drawn attention to the puckering up and tightening of the uterosacral ligaments as a means of re-forming the fossa ovarica, in which the ovary comes to rest quite naturally, out of reach of painful circulatory disturbances.

The operation recommended by C. C. Barrows of New York and adopted by Ward consists in perforating the broad ligament of the mesosalpinx with an artery forceps, avoiding the vessels, then drawing the ovary through the buttonhole opening and stitching it in place by a suture at each end. The experience of Barrows and Ward shows that this operation entails no disadvantages, relieves the discomforts permanently, and obviates a recurrence of the trouble, apt to take place under other methods; it does not prevent pregnancy. Of Barrows's thirty-seven cases, five were double, thirty-two were single—twenty-one of the right ovary and eleven of the left.

My own method has been to shorten the utero-ovarian ligament by doubling it on itself and then stitching it to the round ligament near the uterus by passing a silk suture through the broad ligament under the fallopian tube.

CHAPTER XXIX

TREATMENT OF UTERINE AND VAGINAL DISPLACEMENTS WITH PESSARIES

HOWARD A. KELLY

In the early days of gynecology, only aggravated displacements were recognized and treated; it remained for our more immediate predecessors—our obstetrical grandfathers and would-be gynecologists—to detect lesser degrees of flexion and downward displacements and, adding them to the list, to undertake their treatment by a horde of pessaries, cups on stems, and later by intra-uterine supports. Those were the days when reputations were made by devising a new instrument or even by putting a new twist or a hump on an old one. Charles D. Meigs estimated that uterine malpositions constituted 75 per cent of all cases coming to him as a specialist in the seventies and eighties of the last century, and the writer recalls the offices of the fashionable obstetrician-gynecologists crowded with women wearing pessaries and tampons. The literature of the period is full of pessary therapy. The present generation, realizing the obvious futility of such methods and enthused by the broader field of gynecological surgery, has done two things: In a large number of instances it has concluded that the pessary and the tampon served but to encourage a valetudinarian habit and was unbecoming to the dignity of the profession, while in another group it has decided that it is best to correct the displacement at once surgically and to curtail the interminable office visits. The first result of this radical step naturally had its own evil consequences, for so long as we continued without criticism to accept our predecessors' dictum as to the seriousness of a retroflexion *per se*, we were guilty of a vast number of unnecessary operations. The intemperance of this new way of treating retro- and even ante-flexions is evident in the published records of a hundred different methods advocated to correct these displacements.

The present status of the matter is that:

1. Many retrodisplacements are considered physiological and call for no treatment, the patient being told that the condition is a negligible one. When, for example, the vagina is preternaturally short, the fundus naturally occupies a posterior position, reclining as it were in the lower sacral hollow.
2. A retrodisplacement in a nullipara calls for interference only when there is a marked flexion associated with bearing down and dysmenorrhea. Retroflexion rarely causes constipation or backache.

3. The form of retrodisplacement oftenest calling for correction is associated with descensus due either to a relaxation of the superior supports or to the breaking down of the vaginal outlet supports or to both. As a corollary, it is useless to correct a retrodisplacement and to neglect a cystocele and a loose, open vaginal outlet.

A pessary is mostly useful in a uterine retrodisplacement, especially retroflexion, where in consequence of childbirth the uterus sags down into the

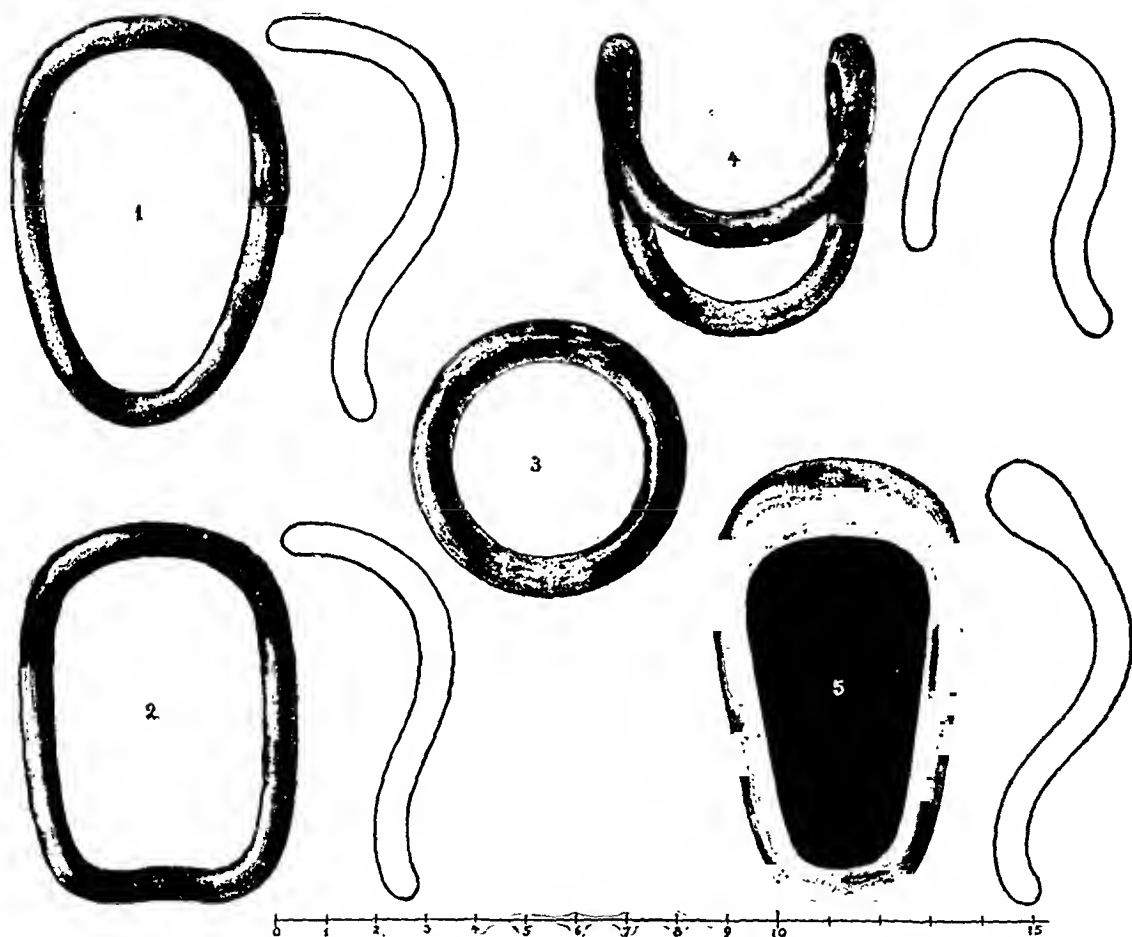


FIG. 369.—FIVE MOST USEFUL HARD RUBBER PESSARIES—SLIGHTLY REDUCED SIZE SHOWN BY CENTIMETER MEASURE BELOW.

(1) Smith pessary with strong upper curve of posterior bar and pointed nose. (2) Hodge pessary with broad anterior bar; curved outline to right. (3) Common hard rubber ring pessary, most generally useful of all. (4) Gehrung pessary, most valuable in cystocele and in prolapse where vaginal outlet is still good; outline to right. (5) Reinforced Mundé-Thomas-Smith pessary. Thomas added thickening of posterior bar to Smith pessary (1), while Mundé broadened pointed nose of anterior bar. All made in several sizes.

vagina, best detected by examining with the patient standing; it is also often useful where for any reason an operation cannot be done or as a preliminary to operation to determine how much is to be expected from the more permanent support given by a suspension. As a rule, it is at most a crutch, a temporary device.

The pessary used must be aseptic and should generally be of hard rubber. Soft rubber pessaries and varnished leather (used by midwives) are prone to become foul and to cause vaginitis.

No practice is more reprehensible than the removal of a pessary from the vagina, rinsing it with warm water and soap and putting it in a drawer with

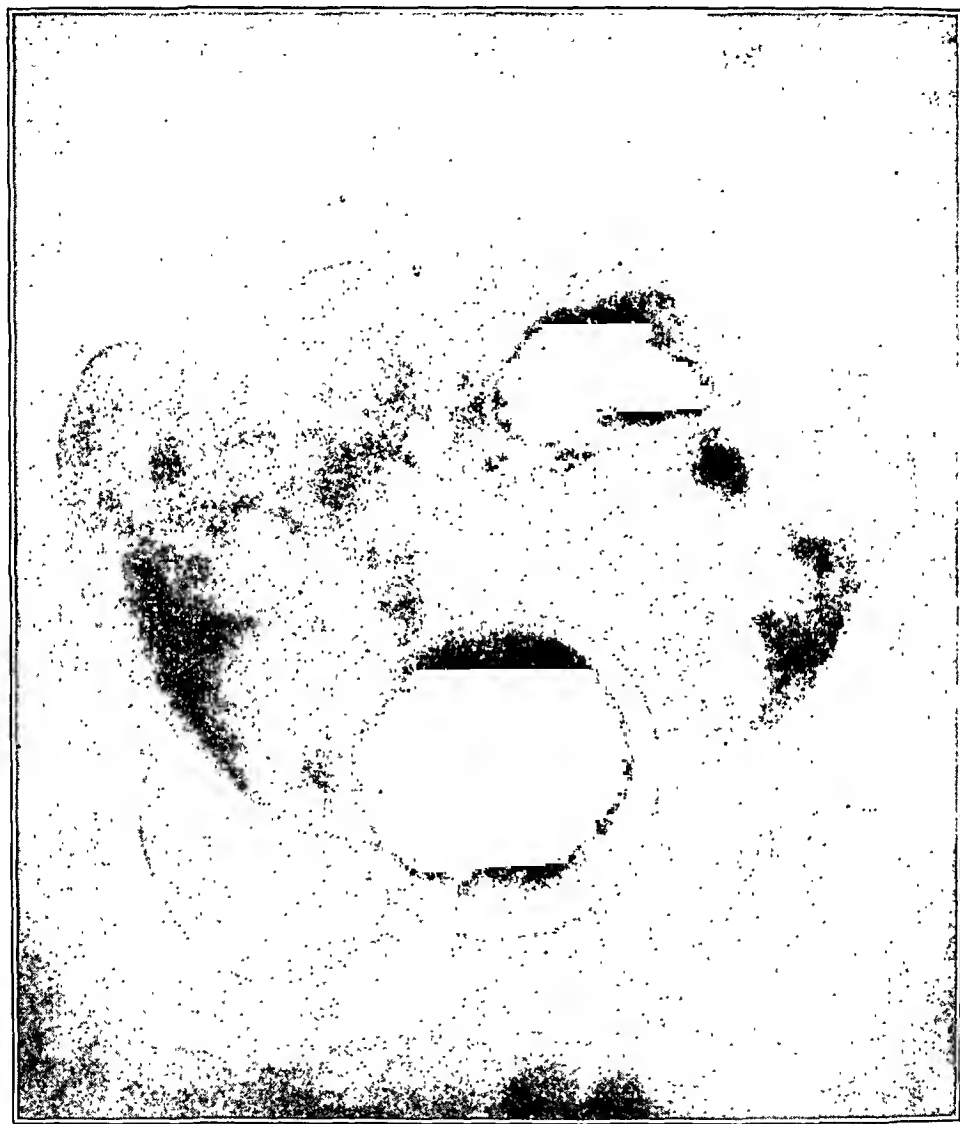


FIG. 370.—GLASS BALL PESSARY IN VAGINA OF AGED WOMAN, EXCELLENTLY SUPPORTING PROLAPSED UTERUS AND VAGINA.

the general supply, in time to be used in another woman. It should be well washed with soap and warm water and then soaked for several days in alcohol and finally wrapped up in sterile gauze.

What does a pessary do? How does it act? Volumes have been written on the mechanics of the pessary and especially on its lever action; my own belief is that its efficacy depends simply and solely upon the fact that it takes up slack and splints the vaginal walls and in this way limits the descensus of



FIG. 371.—INTRODUCING RING PESSARY, BY DRAWING BACK POSTERIOR VAGINAL WALL AND PRESSING BACKWARD WITH PESSARY INTRODUCED IN SLIGHTLY OBLIQUE DIRECTION.

Avoid pressing upon pubic bone or more sensitive structures near symphysis.



FIG. 372.—INTRODUCING SMITH PESSARY.

Index finger of left hand pulls back vaginal wall, while right hand introduces pessary without bruising anterior structures.

the uterus. If this is true, the purpose of the pessary is not to correct a retrodisplacement nor to establish the uterus in any conceivably ideal posture; therefore, in selecting and applying a pessary one pays no attention whatever to the posture of the uterus after its application. The kind and size of the pessary selected depend upon the amount of slack in the vaginal walls and the

amount of descensus of the uterus, the displacement of the anterior vaginal wall (cystocele), and the competency of the posterior wall at the outlet to retain the instrument.

My own preference is for the following hard rubber pessaries: A simple ring, a Gehrung pessary, a disk and stem (Menge) pessary for prolapsus, and a hard rubber or glass ball for prolapsus, Figures 369 and 370.

The old-fashioned ring pessary is the most universally applicable and were it not for cases of cystocele might almost be adopted as the one instrument for all cases. It takes experience and sometimes several efforts to adjust the right instrument for the individual case, the effort being much like that of getting a new pair of shoes. A suitable pessary takes its place in the vaginal

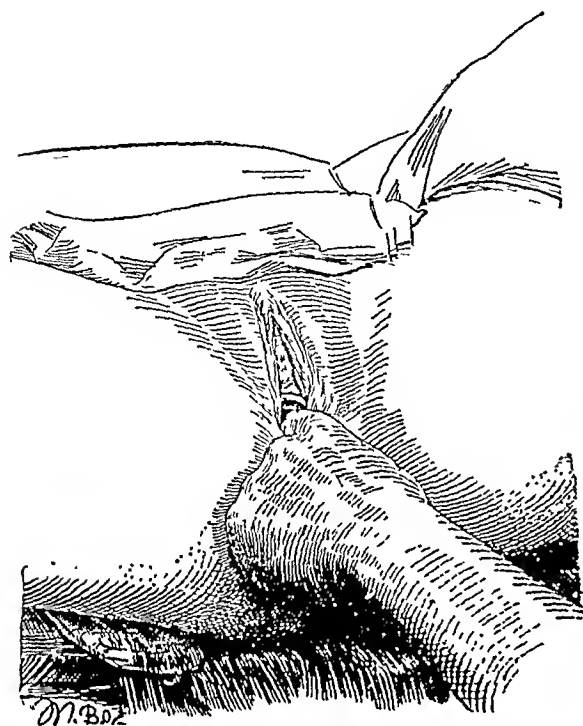


FIG. 373.—CARRYING SMITH PESSARY INTO PLACE.

Pessary introduced into vagina caught by index finger resting upon its posterior bar and carried well behind cervix, when pessary is in position.

vault with the cervix in the center and fits loosely and comfortably with room to introduce the index finger easily between the pessary and the vaginal walls on all sides, Figures 371, 372, 373, 374, and 375; it must not make constant pressure at any point. I have often had occasion to remove pessaries several sizes too large (I call them "horse pessaries") ulcerated through into rectum or bladder or both. Sometimes a pessary is just about the right size to give relief but the vaginal outlet is too relaxed to hold it; it is then most apt to escape in the act of defecation. The patient feeling the pessary protruding, can push it back with a finger, being assured that it cannot get into the wrong place and do harm.

The Gehrung pessary is the one usable form when there is a cystocele where, instead of presenting at the outlet and escaping like a ring or Smith-Hodge pessary, because of lack of a presenting rounded surface it simply rolls over inside; I call it an "upset pessary," (Figure 376). It is readily made out of one of the ring pessaries by heating in boiling water until soft and then



FIG. 374.—SHOWING RING PESSARY IN PLACE AND ITS RELATIONS TO CERVIX AND VAGINAL VAULT.

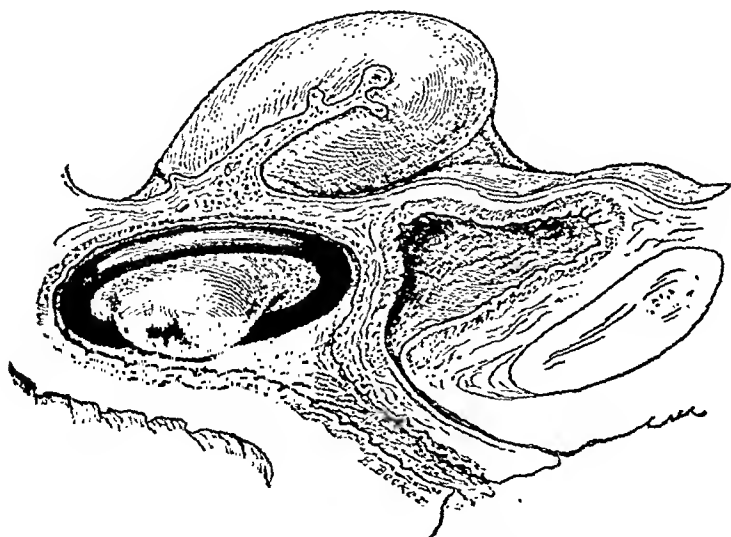


FIG. 375.—HARD RUBBER RING PESSARY AT VAGINAL VAULT ENCIRCLING CERVIX AND SERVING TO LIMIT TENDENCY TO DESCENSUS.

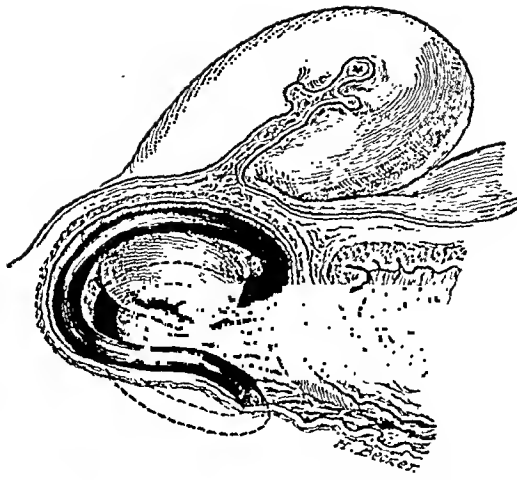


FIG. 376.—GEIRUNG PESSARY.

Especially useful in descensus of anterior wall. Pessary should lie in closer relation to symphysis pubis.

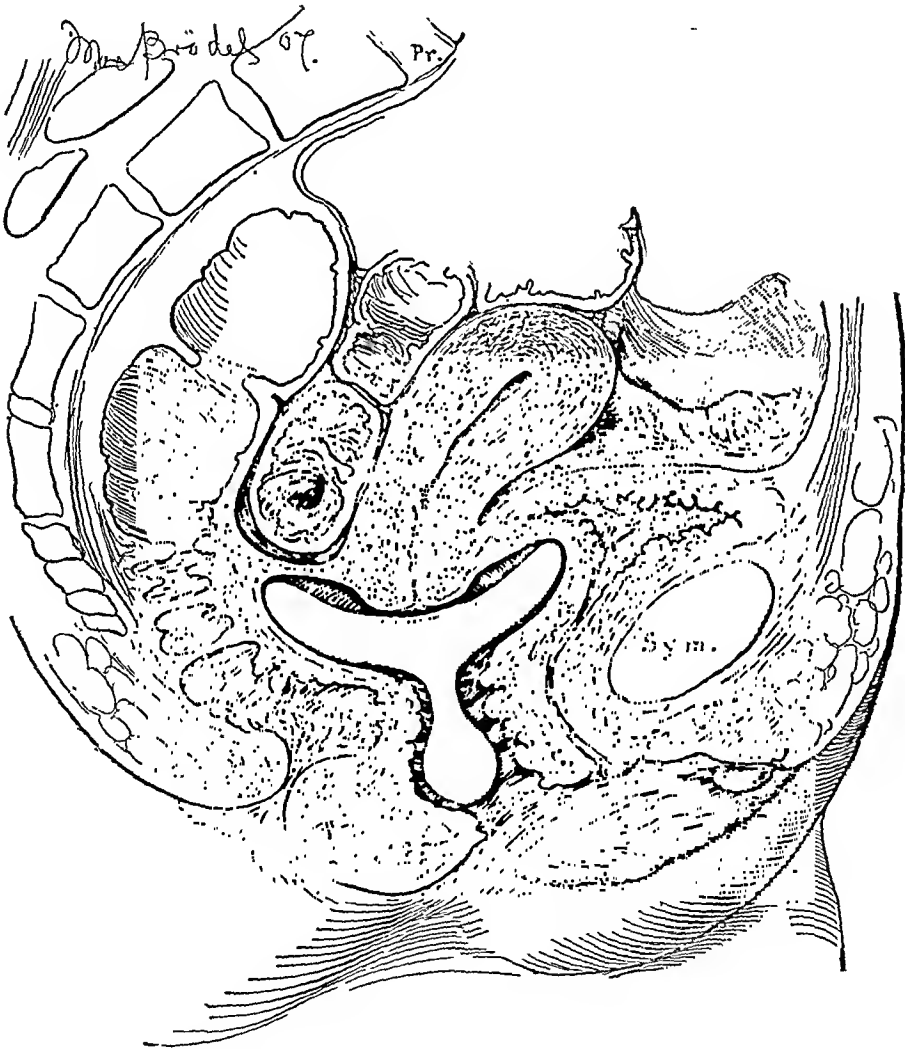


FIG. 377.—A MENGE PESSARY USEFUL IN SOME CASES OF PROLAPSED UTERUS.

Stem prevents pessary from rotating and thus from presenting at vaginal outlet and escaping.

lifting quickly on to a gauze napkin held in the hand and squeezing it together from side to side and at the same time doubling it on itself in the opposite direction until it has the form indicated, when it is at once held under cold running water to harden.

The form most valuable for prolapse in the old is the Menge with a removable stem inserted and caught by a bayonet lock after placing the ring, Figure 377. The stem rests on the vaginal outlet and prevents the supporting ring from appearing at the outlet and escaping. An excellent pessary for the old, where in spite of an apparently fair support at the outlet the lax tissues above tend to evert with the uterus, is a glass ball, between 4 and 6 centimeters in diameter; this should be lubricated and introduced into the vagina with a little stretching of the outlet. If not too tight a fit, such an instrument may be left *in situ* for months. It is not always easy to remove although there would be no difficulty with a pair of miniature obstetric or a large polyp forceps. I generally assist the extraction with *vis a tergo* or a finger in the rectum pushing the ball down.

A woman wearing a pessary ought to douche daily if there is any discharge, using a heaping teaspoonful of table salt dissolved in a pint of warm water or a teaspoonful each of soda bicarbonate and soda biborate with a grain of menthol, in a pint of warm water.

A pessary patient ought to appear for examination every few months.

CHAPTER XXX
BENIGN TUMORS OF THE UTERUS
HOWARD A. KELLY

INCIDENCE

SYMPTOMATOLOGY

SITE

FORM PECULIARITIES

DIAGNOSIS

TREATMENT

Ray Therapy

Myomectomy

INDICATIONS

OPERATION

Hysteromyomectomy

INDICATIONS

OPERATION, INCLUDING UTRICULOPLASTY, BISECTION, AND PANHYSTERO-MYOMECTOMY

COMPLICATIONS

1. *Globular Myoma*
2. *Torsion*
3. *Adenocarcinoma*
4. *Cancer*
5. *Angioma*
6. *Suppurating Myoma*
7. *Tuberculosis of the Endometrium*
8. *Ascites*
9. *Pregnancy*
 - (a) Intra-uterine
 - (b) Extra-uterine
10. *Environmental*
 - (a) Bladder and Ureters
 - (b) Adhesions
 - (c) Tubal and Ovarian Disease

Myoma of the uterus, fibroid tumor, or fibromyoma, according as one or other element prevails, is an atypical nodular growth springing from some portion of the uterine body, usually above the cervix, varying in size from a microscopic node to that of a mass or masses choking the abdominal cavity. The tumor is made up of a disorderly interlacement of muscular and connective-tissue fibers, one or the other predominating; the larger masses are grouped into more or less well-defined spherical nodules.

Between the conglomerations of fibers run arteries, veins, and lymph chan-

nels derived from the normal uterine vessels, ramifying at first beneath the capsule of the tumor and then plunging directly into its interior which is on the whole notably avascular. Isolated tumors within the uterine walls are circumscribed and embedded in the normal muscular fibers; tumors projecting through the muscular wall become covered on the uterine side by the mucosa and on the abdominal, by peritoneum.

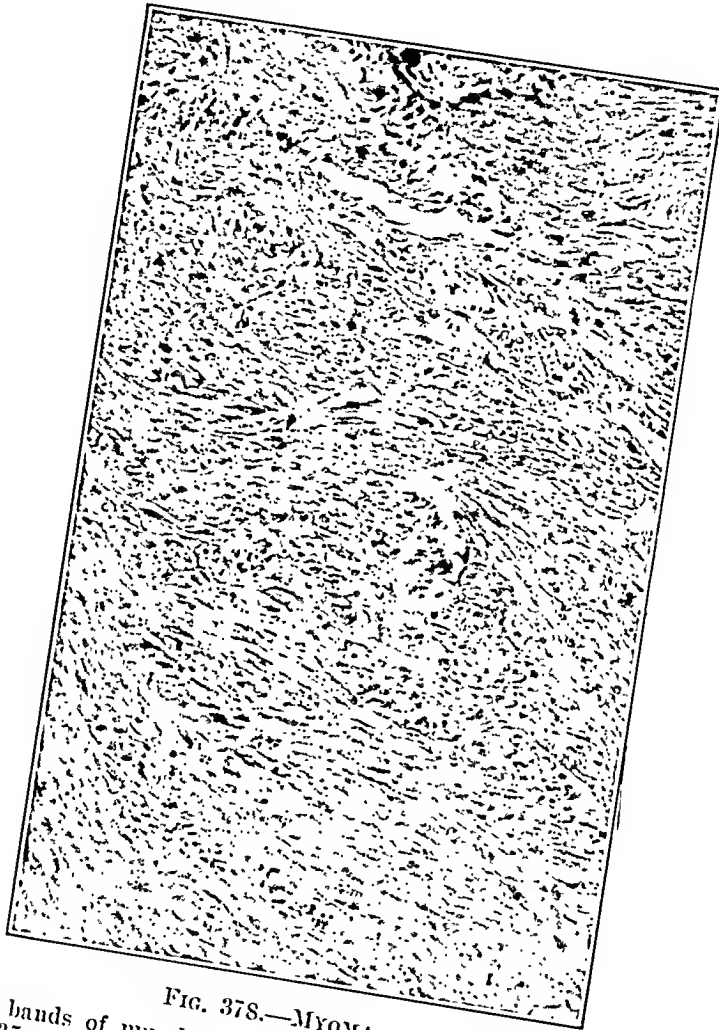


FIG. 378.—MYOMA.

Showing interlacing bands of muscle-fibers, some cut transversely, others longitudinally.
(J. H. U., Gyn.) $\times 235$.

The uterine musculature up to a certain point undergoes a massive hypertrophy, encapsulating growths even as large as an adult's head. As the tumor grows, especially on the peritoneal side, it takes its nourishment more and more from those parts of its capsule which lie nearer the uterus and are subjected to less pressure. In this way the capsule becomes progressively thinner until the mass finally comes to lie directly under the peritoneum, or is simply sessile on the uterine body, or becomes pedunculate, or, rarely, is detached from the uterus and parasitic, especially on the vascular omentum.

The hypertrophy of the enveloping uterine muscle in one case was such that

GYNECOLOGY

while the tumors weighed 1950 grams, the uterine shell, after they were removed, weighed 635 grams.

A rare tumor, the lipomyoma, occurred in our lists, Figures 379 and 380, reported by J. M. Knox (*Johns Hopkins Hosp. Bull.*, Oct. 1901, p. 318; also, Lockyer's *Fibroids and Allied Tumors*, 1918, p. 61). In our patient, aged sixty-two, it reached almost to the umbilicus. Microscopically, it was a fibroid

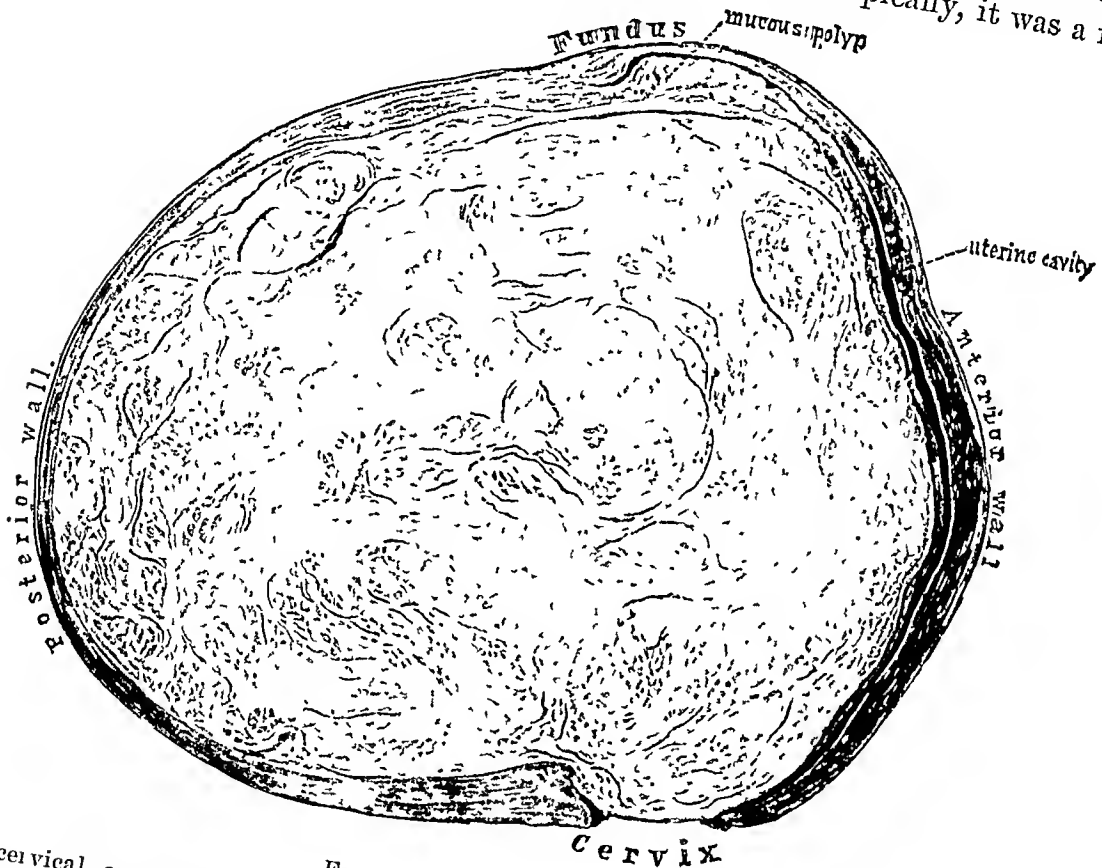


FIG. 379.—LIPOMYOMA.

Intracervical amputation of uterus. Interstitial myoma in posterior wall distorting uterine cavity. Mass consists to great extent of adipose tissue. (See Fig. 380.) (J. H. M. Knox, Jr.) (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{2}{3}$.

with abundant fat in all parts. The figures show well the appearance of the glistening bands traversing the yellow soft areas.

Incidence.—Although all myomata probably exist in fetal life as seedlings, they are rarely evident until menstruation has continued for some years; that is to say, up in the thirties and near middle life. Myoma is commoner in the colored race.

Symptomatology.—Early clinical signs are painful menstruation, which is also often excessive, and in married women sterility or repeated early miscarriages. Thus many women treated for sterility and intractable dysmenorrhea are found ten or fifteen years later with a multinodular fibroid uterus. The tumors at first occupying the pelvis grow up toward the abdomen and,

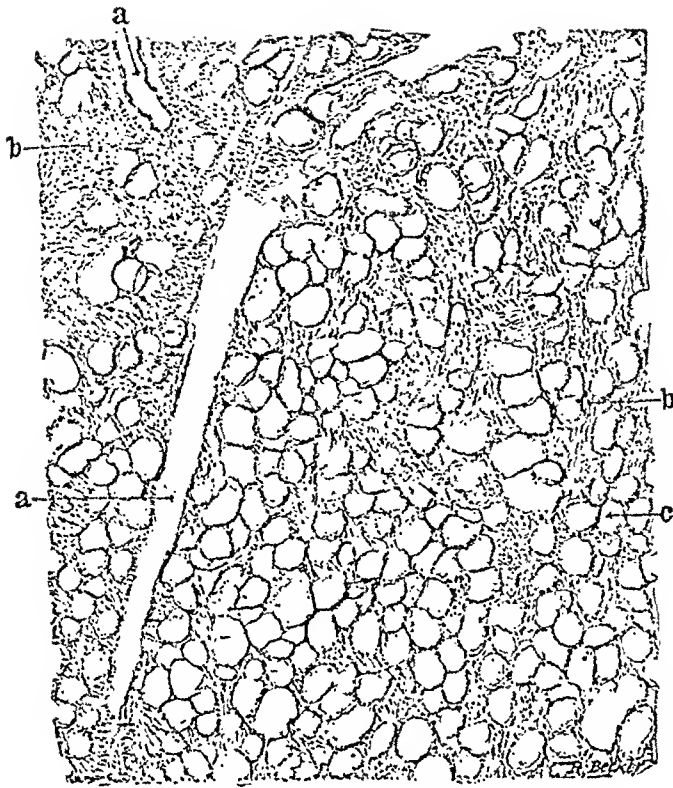


FIG. 380.—LIPOMYOMA.

Section from Figure 379. *a*, Blood-vessels; *b*, myomatous tissue; *c*, clear spaces representing fat cells. (J. H. M. Knox, Jr.) (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times 48$.

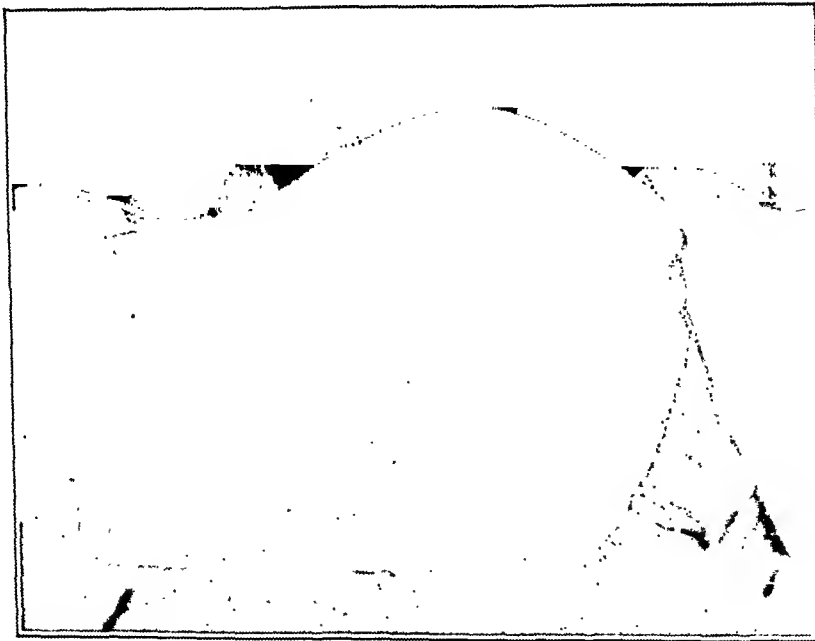


FIG. 381.—ABDOMINAL CONTOUR OF A SINGLE MASSIVE MYOMA REMOVED BY MYOMECTOMY.

GYNECOLOGY

increasing slowly, do not as a rule attract attention by their size until they have exceeded the capacity of the pelvis and occasion a symmetrical or nodular enlargement of the lower abdomen manifest on inspection and still more evident upon palpation.

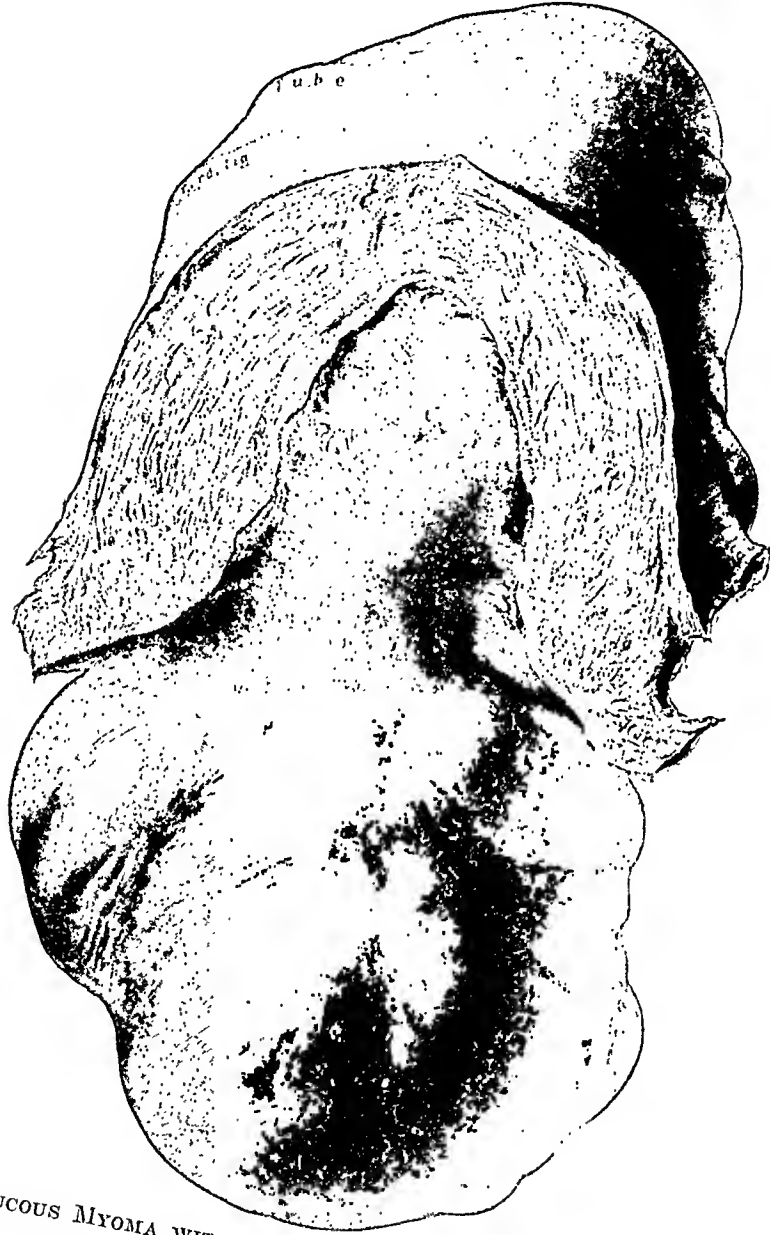


FIG. 382.—LARGE SUBMUCOUS MYOMA WITH ENLARGED, HYPERTROPHIED, MYOMATOUS UTERUS WITH THICK WALLS.
Submucous tumor in vaginal vault; broad pedicle depends from cervical portion.

If the growth starts under the mucosa, it is apt to remain smaller in size, and as it is extruded into the enlarged uterine cavity, it gives rise to hemorrhages and even ultimately becomes pedunculate and distends the cervix, presenting at the os and escaping partially or wholly into the vagina. Sometimes nature's ineffectual efforts to cast it off bring about an inversion of a

part or the whole of the uterus which then resembles a thick pedicle at the vaginal vault. Rarely, a fine peritoneal channel is found inverted into the pedicle of a myoma which springs from the lateral uterine wall (Werth). A large submucous tumor is liable to infection when it breaks down and sloughs; many lives have been sacrificed in this way to the attendant sepsis and hemorrhages.

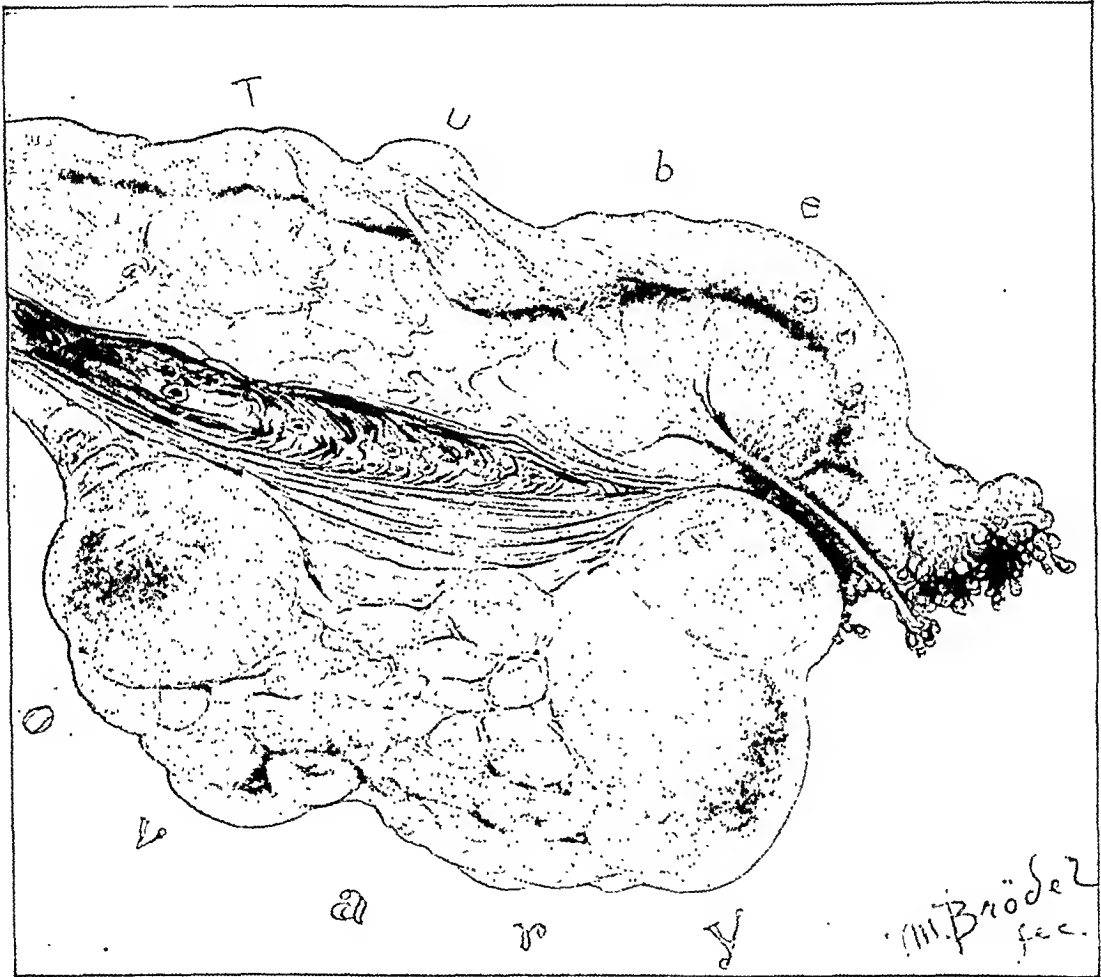


FIG. 383.—GREATLY ENLARGED RIGHT OVARY REMOVED WITH A MYOMATOUS UTERUS THE SIZE OF A MAN'S HEAD.

Large unruptured cysts at both poles; in between, a mass of thick cirrhotic ovarian tissue. $\times 1$.

The rate of growth is variable; it sometimes takes ten, fifteen, or twenty years to reach the size of a uterus at term. Some of the more vascular, however, enlarge perceptibly within a few months, though not always so rapidly as the patient imagines. Even doctors are apt to make mistakes on this head.

Profuse menstrual hemorrhage, the most striking symptom, occurs in about 50 per cent. At the beginning it is more an exaggerated period, lasting from five to eight days; although weakening, it is soon compensated. Later, as the

tumor enlarges, the flow is longer and more excessive. A profound anemia is not uncommon, the skin becomes peculiarly transparent and waxy, and dyspnea supervenes and epistaxis and palpitation, with profound weakness. A loud anemic heart murmur connotes blood changes.

Pain is variable, most marked when the uterus carries small myomatous masses in its walls, when it is usually menstrual and of a distressing, grinding, bearing-down character, like labor pains.



FIG. 384.—MYOMATOUS UTERUS WEIGHING 39 POUNDS, SEEN FROM BEHIND.

Extreme distortion of uterine body by tumors occupying every conceivable position. Point of amputation of cervix shown at *C*, right and left ovaries and tubes above on each side. Left tube lengthened and displaced by large intraligamentary mass. Lower part of tumor, from point above cervix transversely across to right, entirely subperitoneal. Hysteromyomectomy. Recovery. Longest diameter 39 centimeters. $\times \frac{1}{3}$.

Some disease of the ovaries and tubes is often found; both may be bound down by adhesions, and a hydro- or a pyo-salpinx may form. This is often present in connection with small tumors, when the pain may be due more to the inflammation and the tugging on the adhesions than to the obvious tumors.

The ovaries undergo hypertrophy, held by Virchow and others to constitute an "interstitial oöphoritis" with cystic degeneration, Figure 383. They are peculiarly long and flat with large unruptured follicles, increased vascularity, and thickened vessel walls.

Popow has shown that the changes affect the albuginea which undergoes

proliferation and a coarse hypertrophy; the follicles in the parenchyma are numerous at first and atrophy later—"oöphoritis follicularis."

Pressure symptoms occur when the growths choke the pelvis, causing frequent urination and, more rarely, difficult defecation. With a growing tumor imprisoned under the promontory of the sacrum, pressure symptoms may become threateningly urgent. It is remarkable how persistently the rectum remains patulous under apparently impossible conditions, while the bladder conserves its office by expanding well laterally or by ascending gradually up

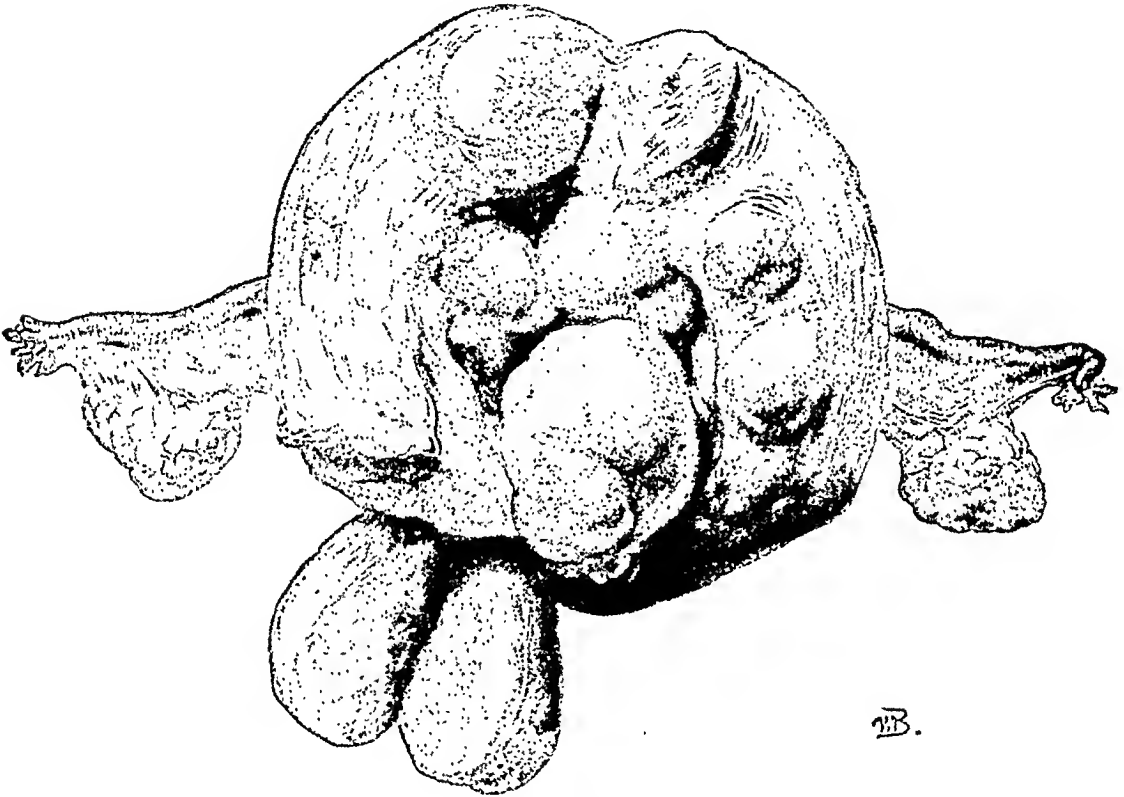


FIG. 385.—UTERUS WITH EXTENSIVE MYOMATOUS INVOLVEMENT CHIEFLY INTERSTITIAL AND SUBMUCOUS.

Note extreme distortion of uterine cavity. Hysteromyomectomy. Recovery. $\times \frac{1}{2}$.

into the abdomen as in other large pelvic tumors. The most serious trouble arises when a tumor molded into the pelvic cavity forces the base of the bladder against the symphysis and cuts off evacuation and circulation. If this is not relieved either by pushing the tumor up into the abdomen or by a radical operation, the sloughing of the entire vesical mucosa becomes but a preliminary to the *exitus letalis*.

The risk of the larger myomata which have escaped up into the abdomen, especially if they lie, as rarely, beneath the pelvic peritoneum, is pressure on the ureters, hydro-ureter, and hydronephrosis, uni- or bi-lateral. In one hundred hysteromyomectomies, there were two with attacks of urinary suppression. It is not uncommon in large myomata to find clear distended tortuous ureters

from the pelvic brim up. One also sees pyelonephrosis with a myomatous uterus, where the infection has been grafted on to a pressure hydronephrosis. Cancer of the uterine cervix and body as a complication recurs with statistical regularity. Out of one thousand in the Johns Hopkins Clinic, there



FIG. 386.—LARGE SOLITARY MYOMATOUS MASS SEEN FROM BEHIND, UTERUS WITH ITS ADNEXA SITTING ON ITS VERTEX LIKE A CAP.

Tumor entirely subperitoneal and subvesical. Uterine cavity in its lower portion greatly spread out. Marked hypertrophy of muscular structure. Vessels of left side plainly seen. Tumor not shown bisected.

were twelve cancers of the body and sixteen of the cervix. This apparently does not imply a causal relationship in the latter instance, although it cannot be excluded in the former.

Site.—A striking and characteristic difference among myomata is a variation in size, all gradations being found, from a pinhead to a mass of a hundred pounds or more.

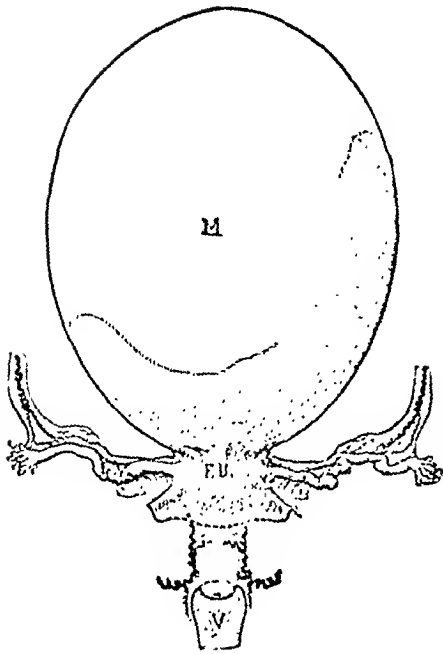


FIG. 387.—LARGE SESSILE SUBPERITONEAL MYOMA.

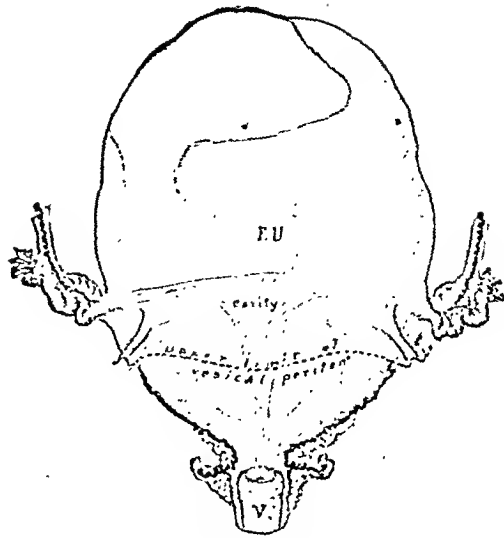


FIG. 388.—MYOMA OF UTERINE BODY.

The terms large and small are used in a purely relative sense, regulated by the environment. While we speak of one not larger than a fist as small, when it is but a little larger and chokes the pelvis, it becomes relatively "a large pelvic tumor"; if the same tumor escapes up beyond the superior strait, as it commonly does, it is a relatively small growth until by its mass it encroaches on the abdominal viscera or even thrusts up the ribs and impedes breathing

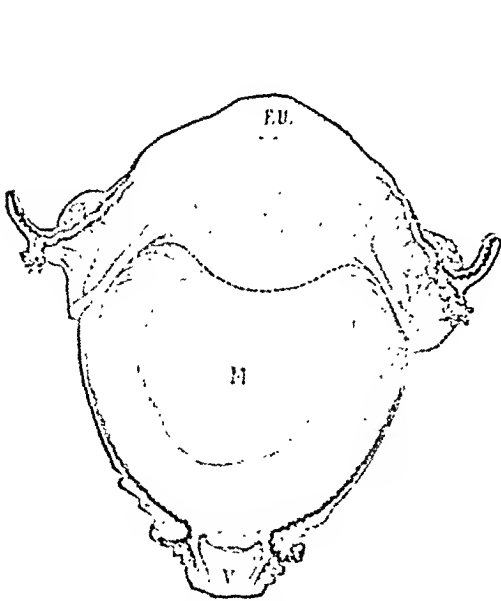


FIG. 389.—MYOMA OF LOWER PART OF UTERUS, SUBVESICAL.

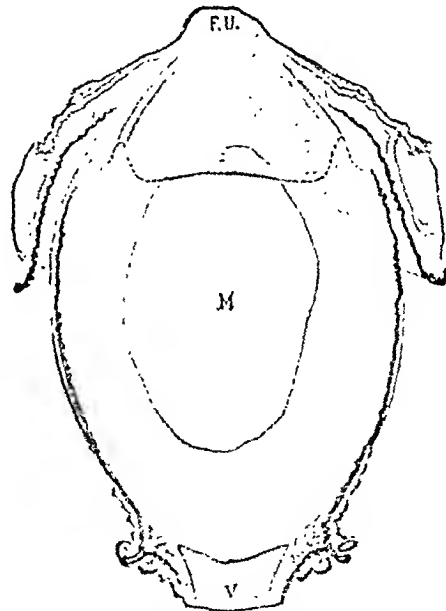


FIG. 390.—CERVICAL MYOMA WITH UTERINE BODY SEATED ON ITS APEX AND WITH EXTREME LENGTHENING OF ROUND LIGAMENTS AND OVARIAN VESSELS.

and interferes with digestion and circulation or generally incommodes its host.

The classification as submucous, interstitial (intramural), subserous (subperitoneal), and sessile or pedunculate is advantageous from a practical standpoint, as often determining the mode of treatment.

From a clinical standpoint, it is important to locate the segment of the uterus in which a fibroid tumor lies, whether fundal, mesial, or cervical, or lateral and intraligamentary, or subperitoneal, or subvesical. Surgical facility is greatly enhanced, the nearer the growth lies to the fundus. I present diagrams representing four sites.

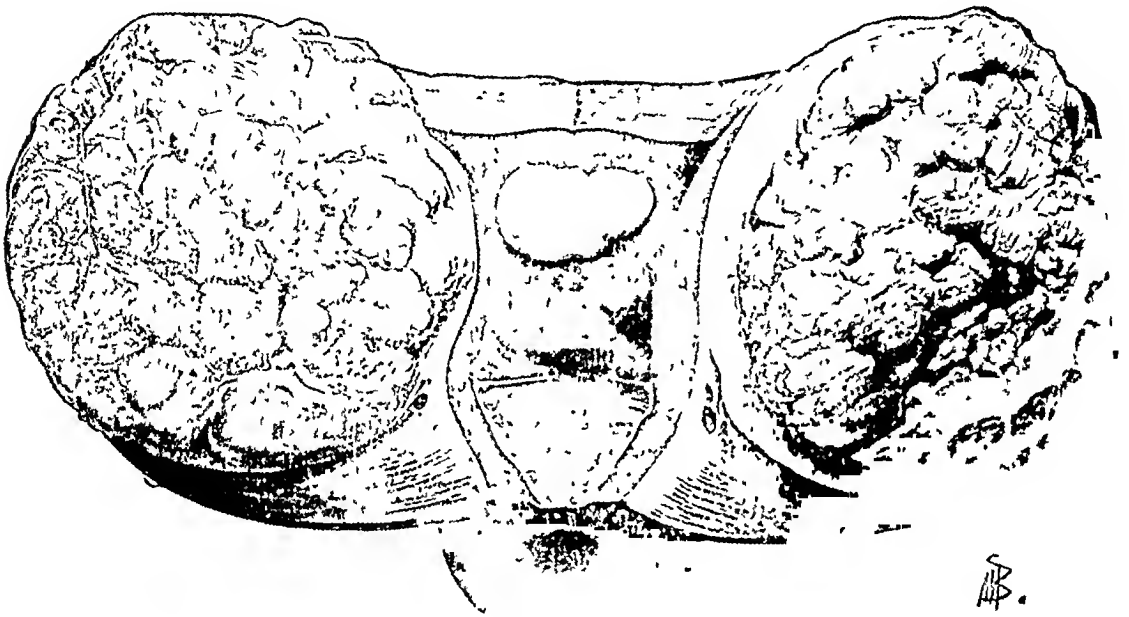


FIG. 391.—MYOMATOUS UTERUS, SHOWING INTERSTITIAL AND SUBPERITONEAL MASSES.

The subperitoneal tumor is half concealed behind opened cervix. Note large uterine cavity with smooth surface, presenting a number of tiny translucent vesicles in lower portion and on lower border of white mucous polyp within uterine cavity. Observe also large vessels laid open opposite internal os uteri. $\times \frac{2}{3}$.

Figure 387, for example, is entirely subperitoneal and fundal, attached by a broad pedicle. A myomectomy in this case is relatively easy. Figure 388 shows a tumor of the same size occupying the body of the uterus, the anatomical elements of which, uterine cornua and round ligaments, are seen widely separated. The removal of such a tumor as a rule (not always) involves hysterectomy, with a careful dissection downward to the bases of the broad ligaments, exposing and controlling the uterine vessels. Figure 389 is the same tumor situated still lower down and more in the cervical portion with the body of the uterus lifted high up; the round ligaments are lengthened and the broad ligaments widely separated. The uterine vessels are not so easy to reach. In Figure 390 the uterus sits on a cervical myoma like a cap. The bladder is lifted up and the basal portion and uterine vessels below are often difficult of approach, Figure 391.



Nineteen centimeters in diameter, lobulated, densely adherent, attached to upper surface of uterus by twisted pedicle. Cysts large and small; all with smooth walls. Solid portion myomatous tissue in hyaline degeneration. Cysts without epithelial or endothelial lining. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{45}{2}$.

FIG. 392.—MULTICYSTIC MYOMA.

Fibrocystic tumors, Figure 392, are degenerated myomata, characterized by an excess of fluid elements, often soft and even markedly fluctuant. The fluid coagulates spontaneously on exposure, a clinical feature valued by the older writers who found it in tapping, as pathognomonic and dictating a policy of *noli me tangere*. The sign is, however, not wholly reliable, as the fluid of

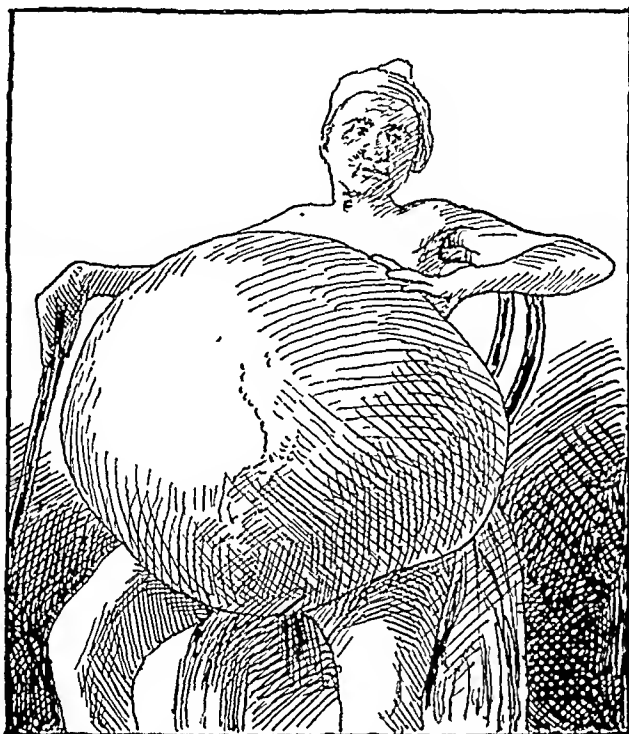


FIG. 393.—ENORMOUS CYSTIC MYOMA.

Patient operated on by Severanu, Bucharest. Entire weight of tumor 85 pounds. Circumference at navel 105 centimeters. (Winckel's *Lehrbuch der Frauenkrankheiten*, 1886 p. 463.)

a tuberculous peritonitis or of a large cystic graafian follicle also coagulates. Fibrocysts sometimes reach a huge size, even as much as 195 pounds!

The tumor figures, Figures 394 and 395, had a girth measure of 92 centimeters and filled the abdomen up to the diaphragm with extensive vascular, omental, mesoelic, and gall-bladder adhesions. Recovery followed operation.

The life history of a myoma is well illustrated in a doctor's daughter, who was watched for twenty-seven years until the successful radical operation in 1894. She discovered her tumor in 1867 when twenty-seven years old. Two years later, Washington L. Atlee, the ovariologist, examined her on one of those long peripatetic operating trips customary among great surgeons from the earliest days and left with her father the following note and drawings, for which I am indebted to his son-in-law, J. M. Drysdale, of Philadelphia.

"Norfolk, Va., June 24, 1869.

"Today I examined Miss J. S. She is as large as a lady seven months advanced, shape uniform, tumor round and prominent, hard, nonelastic, mov-

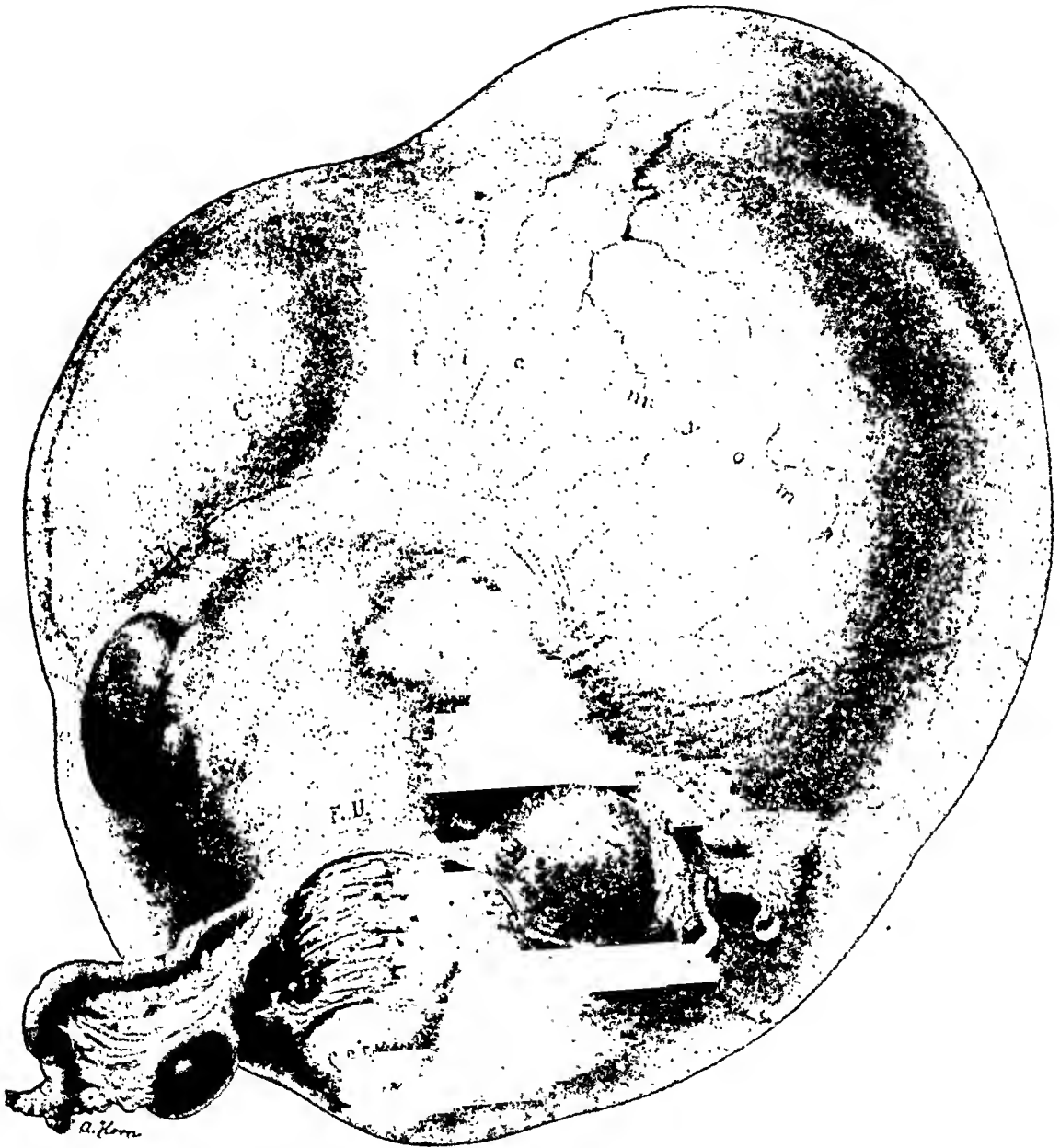


FIG. 394.—LARGE CYSTIC MYOMA 31 X 27 CENTIMETERS.
Removed by panhysterectomy; small dermoid cyst found on the left side. F. U. shows position of fundus uteri. Little more than $\times \frac{1}{2}$.

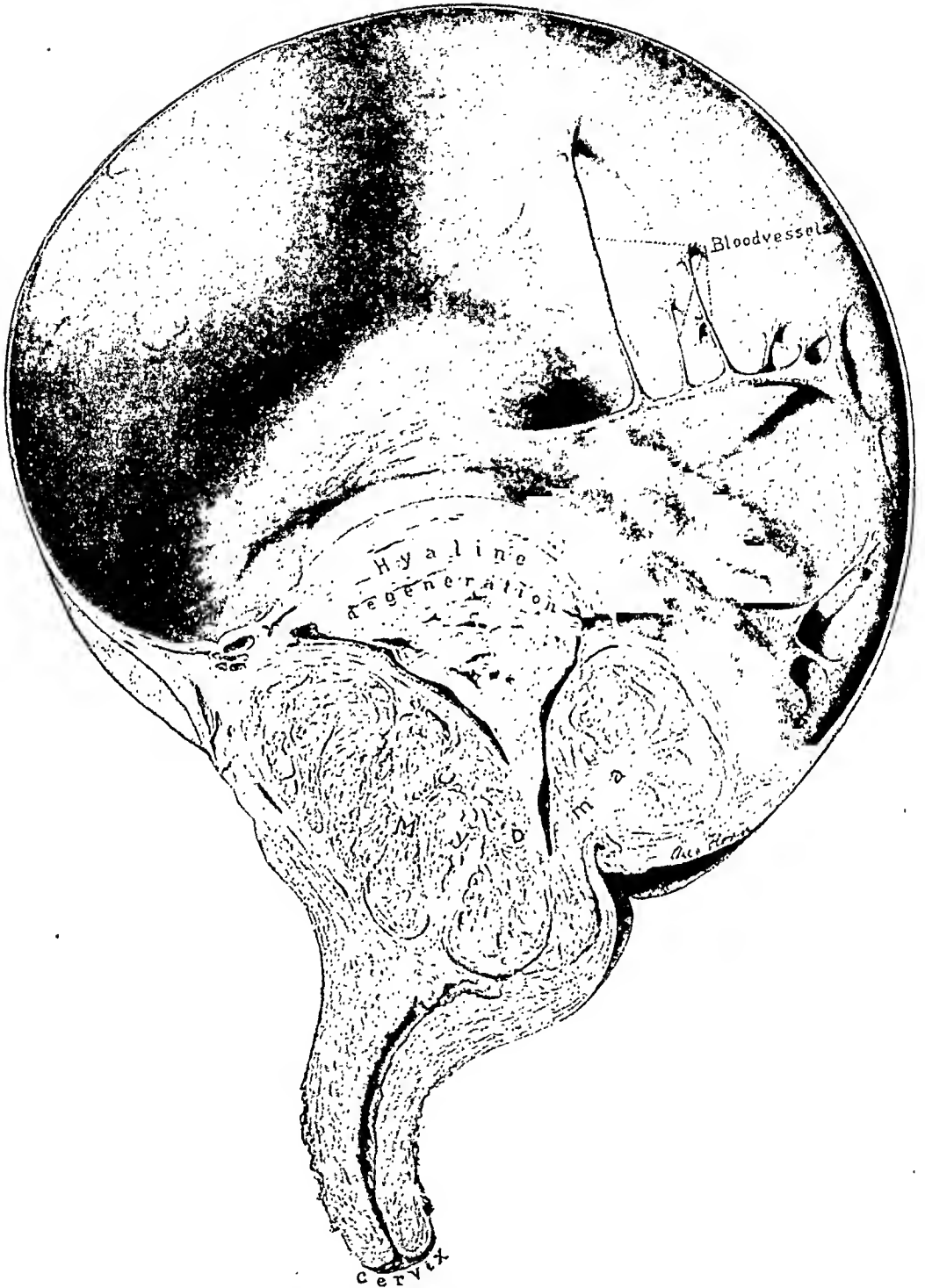


FIG. 395.—TUMOR SEEN IN FIGURE 394, EXHIBITING RELATIONSHIP OF THIN-WALLED CYSTIC PORTION TO MYOMATOUS TISSUE PERSISTING AT BASE WITH AREA OF HYALINE DEGENERATION ABOVE.

Tumor may be readily mistaken for an ovarian cyst. Note trabeculae of skeletonized blood-vessels.

able, not sensitive, extends across both hip bones and upward to the hypochondria. The superior strait of the pelvis is occupied by the same tumor and in the posterior part the cervix uteri is felt. It is shortened in length, folded against the tumor in front, soft. The sound enters to the distance of eight or nine inches.

"The following diagrams will explain things."

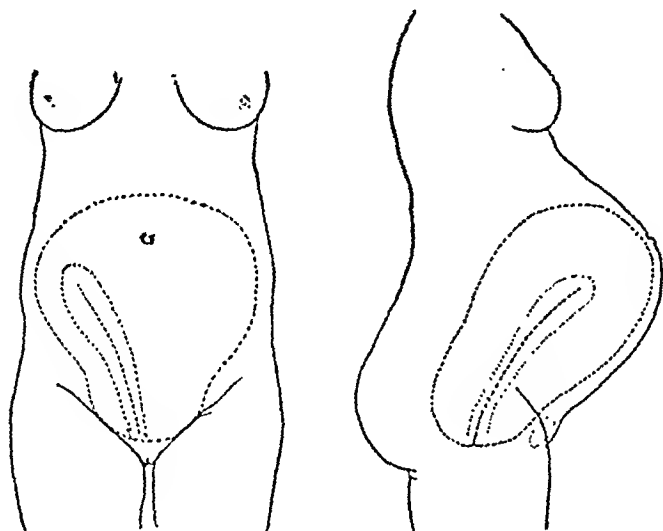


FIG. 396.—COPIES OF SKETCHES MADE BY WASHINGTON L. ATLEE IN 1869.

Note length of uterine cavity and intimate relations of myoma with uterine walls. Seen twenty-five years later, uterus was normal size, and tumor was attached to fundus by a pedicle 1 centimeter long.

Many years later she was treated repeatedly (after Apostoli) by A. J. Skene of Brooklyn with heavy electric currents through the abdomen, as was the fashion some forty years ago.

When I saw her in May, 1894, the abdomen was enormously distended by the huge symmetrically disposed tumor. The anterior wall was 48 centimeters from the bed level as she lay on her back. Her umbilical circumference was 128 centimeters and the distance from umbilicus to ensiform cartilage was 114 centimeters. There was also an ascites. She had an umbilical hernia, opening 6 by 7 centimeters, and a tender, round mass under the arch of the right ribs—a distended gall-bladder. She suffered acutely with renal colic from pressure on the ureters.

The operation, May 12, revealed a small uterus crowded against the pelvic floor, with a fibroid mass of 59 pounds, attached to the anterior uterine wall by a pedicle 1 centimeter long and 3 by 2 centimeters broad, nourished by three large arteries 5 millimeters in diameter, coursing superficially over the anterior fundus.

The extirpation was long and difficult because of the extensive plaquelike vascular ventral adhesions, due to the electricity used. The large gall-bladder was opened and a quantity of pus evacuated and drained.

The recovery was uninterrupted and she lived seven years longer in excellent health; her death was unconnected with her old ailments.

It is a matter of interest to note the entire change in position from the migratory evolution of the large tumor.

One of the most important notes affecting the operation is that the cervix is either free and normal in the vagina or that it is deployed to a greater or less extent on the growth. A good cervix means an easier extirpation.

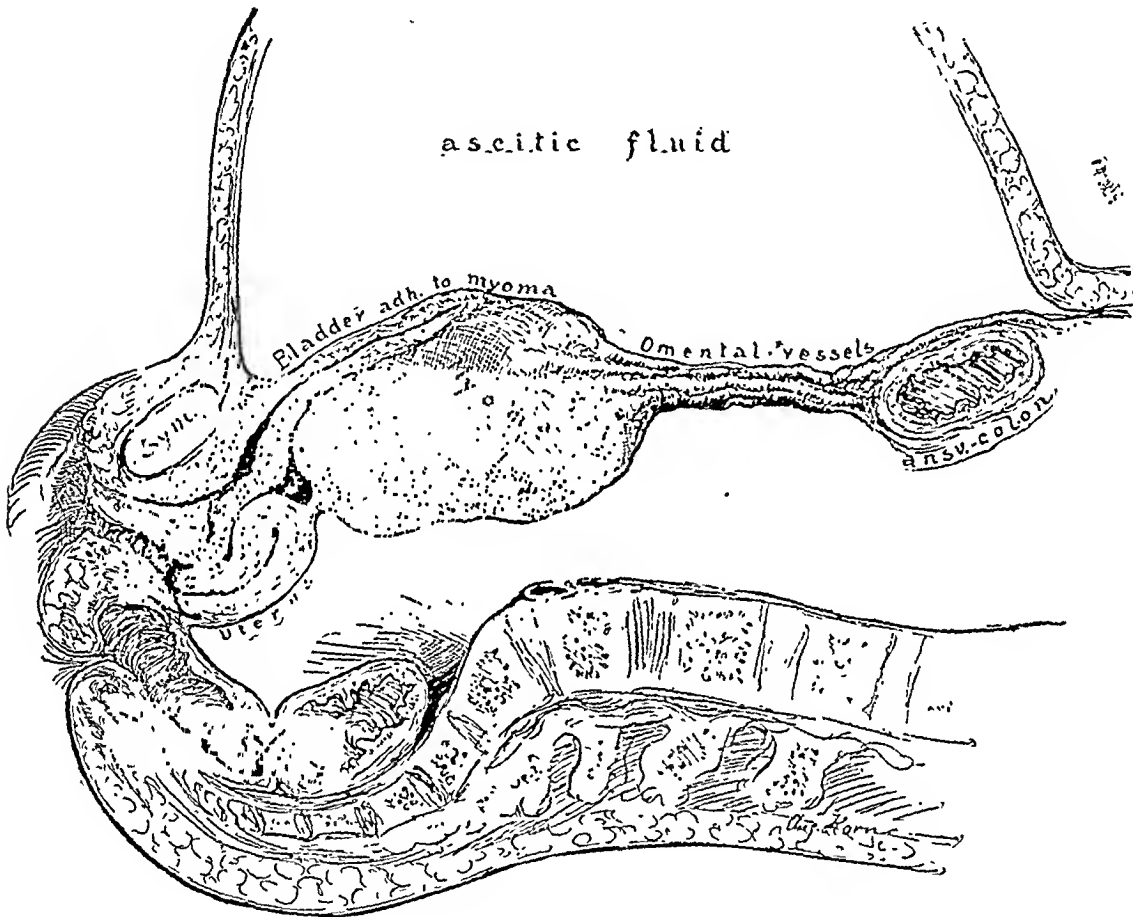


FIG. 397.—PARTIALLY PARASITIC MYOMA.

Associated with 51 liters of ascitic fluid. Tumor attached to fundus by narrow pedicle and by large vessels to omentum; also intimately blended with posterior surface of bladder. (T. S. Cullen.)

In parasitic myomata, the omental attachments often present a striking appearance, fringing the upper border of the mass with large tortuous vessels like a cluster of whipcords or angleworms stretching from tumor to colon. These are often very bizarre in their relations.

While multiple myomata are commonly met, there is at times a remarkable tendency to harbor only a single tumor, forming a big symmetrical spherical mass. The solitary myoma deserves special attention, as it is just here that a skillful myomectomy may save the uterus, conserving its functions even to the extent of childbearing.



FIG. 398.—PARTIALLY PARASITIC MYOMA.
 With large vessels from fallopian tubes. Large lobulated myoma from posterior surface of uterus with short pedicle (a). Adventitious nutrient vessels as shown. No evidence of pelvic peritonitis. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{1}{2}$.

Form Peculiarities.—A single myoma unrestrained assumes a more or less spherical form which it retains until pressure molds it. Two sets of external forces, the hard and the soft parts, come into play in this modeling process. Irregular outlines, arising from forces within the growth itself, are found in the coincident development of a number of tumors with fresh nodules

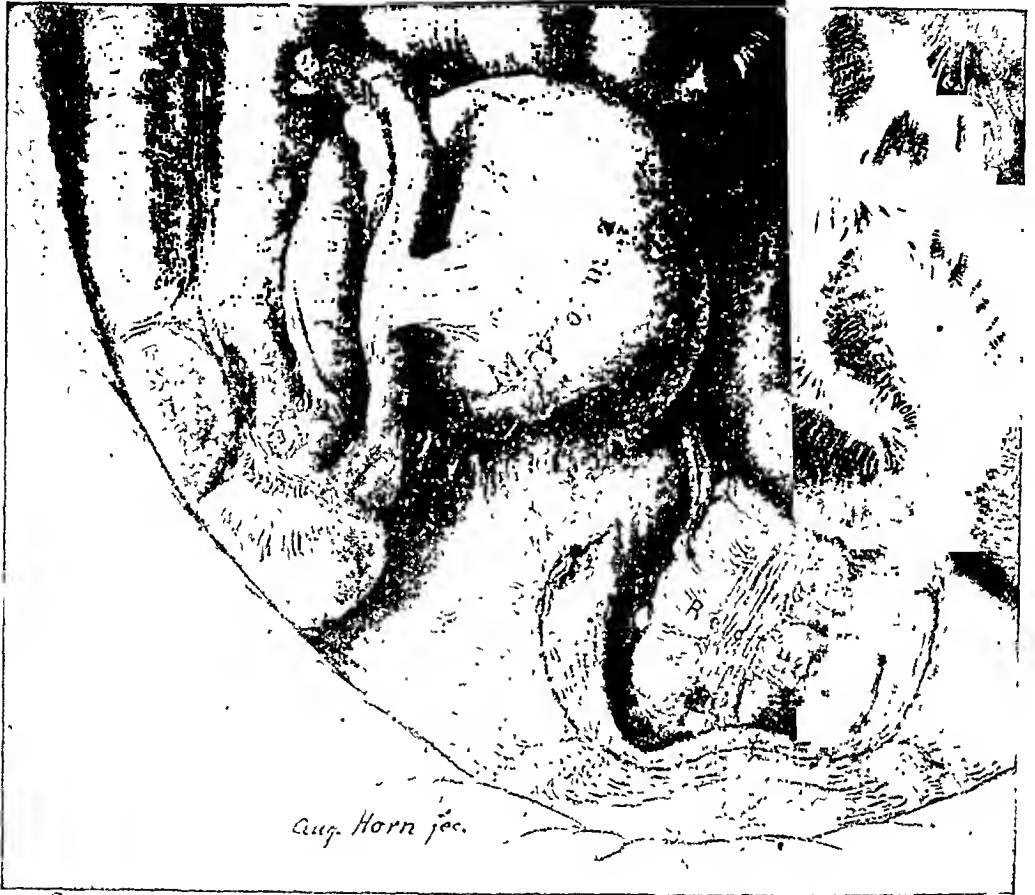


FIG. 399.—PARASITIC MYOMA COMPLETELY DETACHED.

Adherent over right ureter and large vessels to appendix. Myomatous uterus with left pus tube removed as indicated by line of suture. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.)

budding out over the surface, when the mass becomes extensively lobulated or bossed.

A striking instance of the effect of repeated impacts of a soft structure is represented by a vertical furrow on a large tumor due to the pressure of the linea alba. Another is the patulous rectum in a choked pelvis, the resultant of a weak force acting with persistent regularity.

When a myomatous uterus is detained within the bony pelvis until the cavity is choked, it assumes the form of a perfect cast of the sacrum and posterior pelvis, exhibiting exquisitely the sacral curve and the breadth of the pelvis. While the surface appears smooth, a close examination reveals the slight irregularities due to suppressed buds. On top of the pelvic tumor,

irregular clusters of large unsuppressed nodules often sprout up through the superior strait.

A notch is seen in some of the larger growths due to the sacral promontory and the projecting bodies of the lumbar spine.

Diagnosis.—When a patient between twenty-five and forty-five complains of painful menstruation, becoming profuse and protracted, and with a history

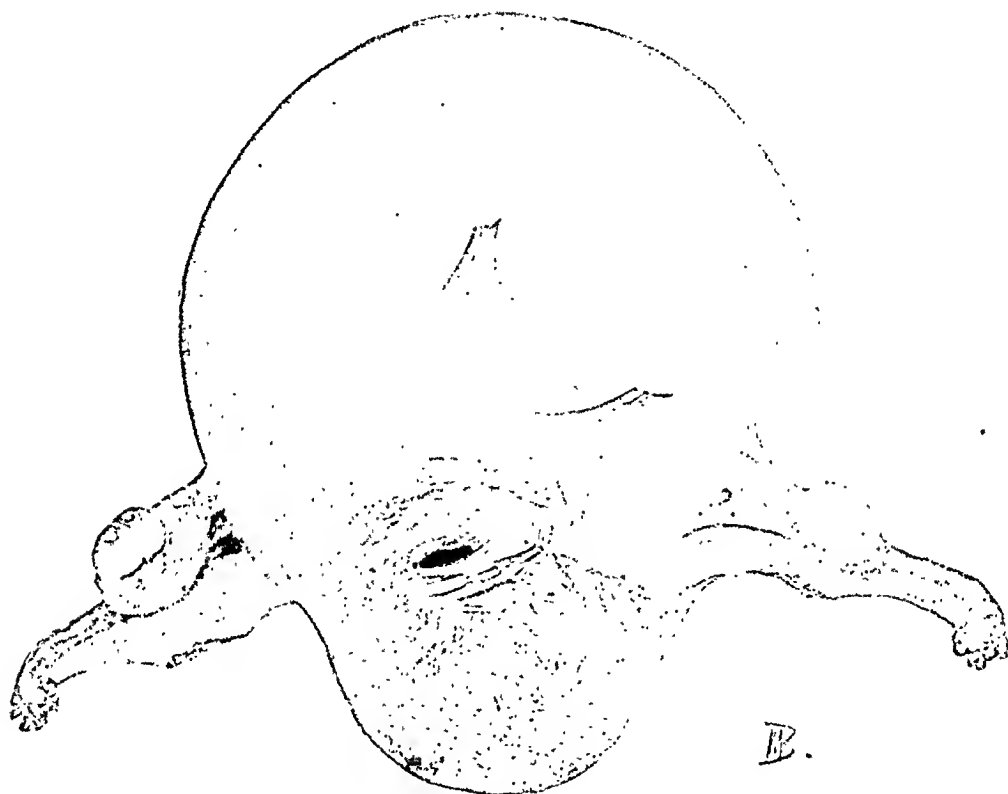


FIG. 400.—GLOBULAR MYOMATOUS UTERUS PRESENTING FORM OF PREGNANT UTERUS AT TERM, WITH ADAPTATION OF LOWER PART TO PELVIC CAVITY.

Lower part of tumor is subperitoneal. Cervix is displaced up to level of pelvic brim. Two peritoneal adhesions shown above cervical opening. Seen from behind. Hysteromyomectomy. Recovery. $\times \frac{1}{3}$.

of sterility or early miscarriages, a myoma may be suspected. A direct examination determines the size and shape of the uterus and any irregularities of its surfaces. To detect and locate accurately small tumors, it is often best to examine under anesthesia relaxation. If the uterus is hard to reach, the following procedure is serviceable: Grasp posterior cervical lip with a tenaculum forceps and pull the uterus toward the outlet; then carry the index finger in the rectum well above the ampulla and palpate bimanually the posterior surface and the whole organ. Small tumors form little nodules easily felt, often not over 3 or 4 millimeters in diameter; larger ones are recognized as hard, rounded, and intimately connected with the uterine body.

A woman was treated symptomatically twenty-five years for dysmenorrhea;

a rectal examination under anesthesia then revealed a small uterus choked with myomata illuminating the history.

When the tumor rises up into the abdomen, the diagnostic signs are more obvious. The lower abdomen may exhibit the characteristic irregular nodular appearance, or, if the tumor is symmetrical, it may simulate pregnancy in form. Here the history of the long-continued growth must be considered in connection

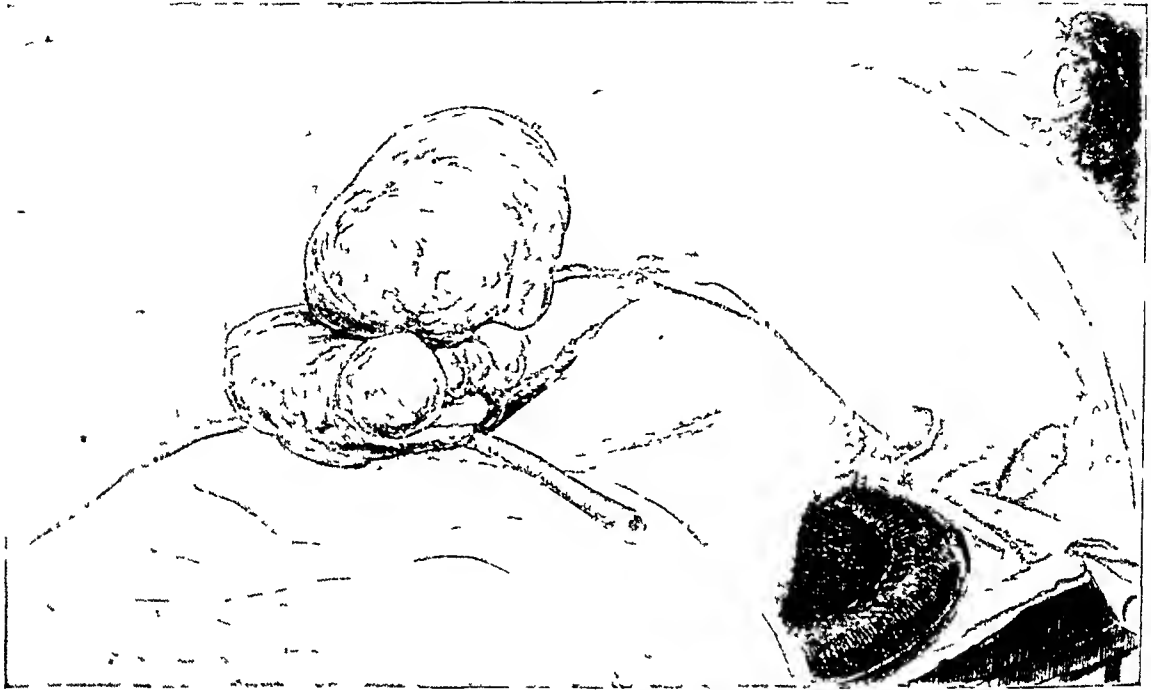


FIG. 401.—MYOMATOUS UTERUS, EXHIBITING PERFECT CAST OF PELVIS.

Rubber ligature thrown around neck of the mass and tied to control circulation, a procedure no longer employed. Uppermost part in picture lay in contact with pelvic floor; tumor, therefore, inverted in lifting it out. Large upper tumor forms perfect cast of sacral curve and posterior pelvis. Note irregular masses, in contact with abdomen just above rubber tube, which projected out of pelvis into abdomen. Hysteromyomectomy. Recovery.

with the other findings. A sound will often show a marked lengthening of the uterine cavity, but it should not be passed until the examiner is morally sure there is no pregnancy. Few operators, if any, have escaped the chagrin of this mistake at one time or another. The rational signs of an advanced pregnancy should be looked for where it is at all possible, remembering also that pregnancy plus fibroids is not infrequent.

A marked peculiarity is often the sharp contour of the upper border of the abdominal tumor as it drops to the level with the patient lying on her back. The resistance is characteristic—hard, dense, unyielding; in exceptional cases, however, all the gradations are found from puttylike, through the soft vascular, to the fluctuating cystic stage, greatly confusing the diagnosis of pregnancy.

In large tumors, the circumference of the abdomen should be recorded, usually at the umbilicus or just below it; a good contour can be made with a flexible leaden tape. The position and size of prominent bosses are also to be

described. A sound passed into the bladder reveals any displacement. Fixation or mobility is tested by rocking from side to side and lifting it up. An important measurement is made with a pelvimeter, with one hand in the pelvis and the other on the abdomen on top of the tumor; also register the breadth.

A remarkable myoma exhibited ballottement as distinctly as in pregnancy. The abdomen was distended as in a pregnancy of eight months, and the uterus,



FIG. 402.—LARGE SUBPERITONEAL MYOMA, SEEN FROM BEHIND.

Showing remarkable adaptation of form to vertebral column. *FU*, fundus of uterus lay on sacral promontory, and mass, *T*, below, lay on pelvic floor, while *T*, above, lay on lumbar vertebrae. From *T* to *FU*, to *T*, tumor is concave, exactly following vertebral column down to pelvic floor. Large tumor exactly adapted in form to lumbar vertebrae from side to side, its concavity presenting cast of lumbar vertebral bodies and sacral promontory. Hysteromyomectomy. Recovery. $\times \frac{3}{4}$.

enlarged by two fibroid masses, reached almost to the umbilicus. Ascitic fluid filled the flanks and the space between the tumors and the abdominal wall. On palpating the abdomen at a point 5 or 6 centimeters above the symphysis, nothing was felt, but on making sudden deep pressure through about 4 centimeters of fluid a hard body was met which faded from touch to return in one or two seconds and strike the fingers a significant blow, Figure 404.

In one patient with multiple fibroids, there was a remarkable mimicry of pregnancy, Figure 403. The mass was 28 centimeters long, lying transversely in the abdomen with a round tumor in the left iliac fossa the size of the head with a necklike constriction. The body of the uterus occupied the position of shoulders, and at the cornu, which was turned toward the anterior abdominal wall, was a conical fibroid excrescence like the stump of an arm. Behind the uterus and lying in the right abdomen, a cylindrical mass bellied out below, resembling the size and shape of the fetal abdomen. Felt through the abdominal walls, the imitation of a dead fetus at term was perfect. E. E. Montgomery observed a similar instance.

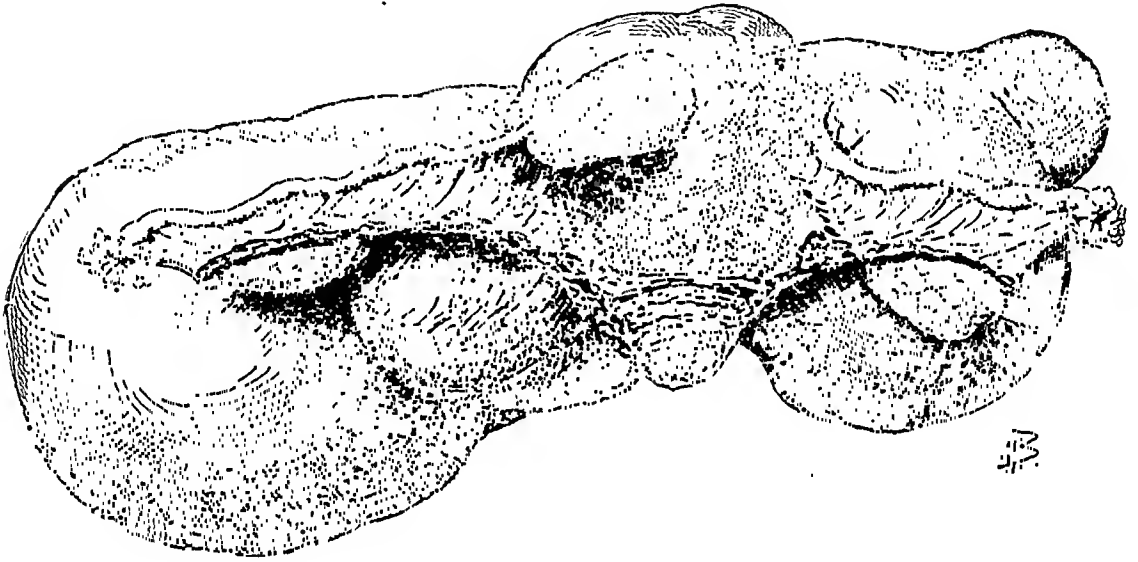


FIG. 403.—MYOMATOUS UTERUS PRESENTING EXTRAORDINARY MIMICRY OF CHILD IN TRANSVERSE POSITION.

Seen from front. Supposed head on left behind left broad ligament with well-defined neck back of uterus. Curious conical nodule extending out under right uterine tube felt like arm of child, while large mass occupying right iliac fossa, and seen behind right broad ligament, had form of body from shoulders down. Longest diameter 28 centimeters. Hysteromyectomy. $\times \frac{3}{4}$.

Photography is especially useful as a record of size and contour.

A gauze tracing is an admirable accurate record, made by marking the periphery of the tumor on the abdomen with indelible ink or a soft pencil and then laying a stiffish gauze on this and tracing the outline on the gauze with a black pencil, Figure 405.

Measurements are especially serviceable in detecting growth.

Treatment.—When the diagnosis is assured and the growth is not larger than a three or four months' pregnancy, and is giving rise to no subjective symptoms, no treatment is called for beyond a watchful inactivity. Accurate observations, however, should be recorded, and the patient advised to return at fairly long intervals for remeasurement, or in case she notes any changes in her condition. It seems quite certain that drugs have no influence over the growing tumor and serve only to upset the stomach.

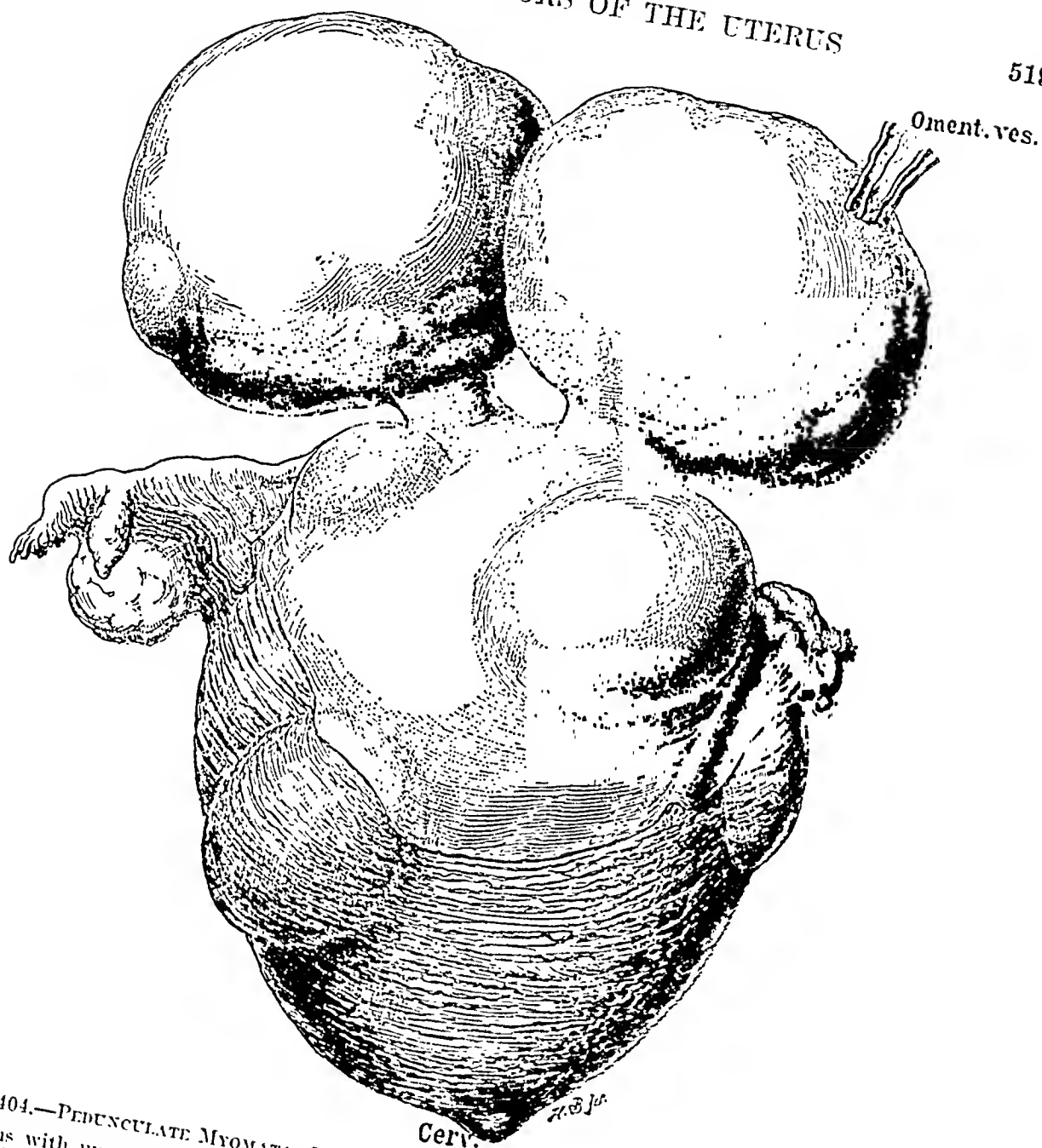


FIG. 404.—PEDUNCULATE MYOMATA, GIVING A PERFECT BALLOTTEMENT. ANTERIOR VIEW.

Uterus with numerous interstitial and sessile myomata; on fundus are two pedunculate tumors about size of child's head at seven months. Abdomen filled with ascitic fluid sufficient to raise anterior wall 2 or 3 centimeters away from tumor on left. Tumor disappeared at once from slight blow to return again immediately and strike finger gentle blow back, imitating ballottement of pregnancy. Note manner in which enlarged omental vessels plunge directly into tumor. $\times \frac{3}{4}$.

The still common notion that all fibroid uteri must be removed is pernicious and calculated to destroy many lives. The mere fact that the percentage risk of the operation is not great does not justify it; there remains also the burden of hospitalization, anesthesia, suffering, expense, and postoperative morbidity, bowel adhesions and obstruction, infections of the abdominal wall, and

hernia. The morbidity and mortality of one hundred taken at random over the country would be far from negligible.

The *furor operativus* which dominated for a couple of decades was generated by an able article by C. P. Noble—an assemblage of the various complications coexistent with these growths.

It took our surgeons, however, several decades to realize that fibroid tumors are extremely common and exist in thousands of women unsuspected and that,

therefore, they accidentally become the concomitants of a vast number of pelvic diseases with which they hold no causal relationship. The question whether to operate or not should usually rest not upon the discovery of a fibroid tumor of moderate size but upon the gravity of the more important accompanying affection.

If the abdomen is opened to treat radically diseased adnexa, a fibroid tumor will determine a more radical operation in the simultaneous extirpation of uterus, tubes, and ovaries as the neater, safer, and altogether better surgical procedure.

There are two groups which call for operation to the exclusion of other methods of treatment. First, that in which the tumor is wedged in the pelvis and creating serious pressure symptoms on the

bladder. The second, that not insignificant group in which there is apparently some intrapelvic complicating condition which cannot be clearly defined or in which even after the most searching examination it is not clear that the fibroid tumor is the only trouble. All doubtful cases, therefore, call for operation. If the last precaution is not respected, malignant intrapelvic disease will crop out at a later date with distressing frequency.

In the active treatment of a fibroid tumor at the present day, the question is no longer merely that of the best way to do a hysteromyomectomy but resolves itself into the choice of one of the several procedures: Ray



FIG. 405.—TUMOR FIRST OUTLINED ON SKIN IN ANILIN OR WITH EYEBROW PENCIL, WITH SUCH LANDMARKS AS ANTERIOR SUPERIOR SPINE, SYMPHYSIS, UMBILICUS, AND MARGINS OF RIBS. GLASS PLATE LAID ON ABDOMEN COVERED WITH TRANSPARENT GAUZE ON WHICH MARKINGS VISIBLE BENEATH ARE TRACED AS PERMANENT RECORD TO FILE WITH HISTORY, WITH ADDITION OF PATIENT'S NAME AND DATE.

therapy or operation—myomectomy, hysteromyomectomy, or panhysteromyomectomy.

RAY THERAPY

The first and foremost method of treatment, always to be considered, is ray therapy, whether x-ray or radium, which is effective in most instances in checking hemorrhages, stopping the growth, shrinking the tumor, or even causing its disappearance. It is ideal for women who have borne children and are in their late thirties or early forties or beyond. Such treatments do not preclude operation later, nor do they necessarily cause permanent cessation of the menses; even pregnancy has followed. This is elucidated in Chapter XLV.

MYOMECTOMY

Myomectomy, the enucleation of the tumor itself without sacrificing any portion of the uterus, is contrasted with hysteromyomectomy, the supravaginal

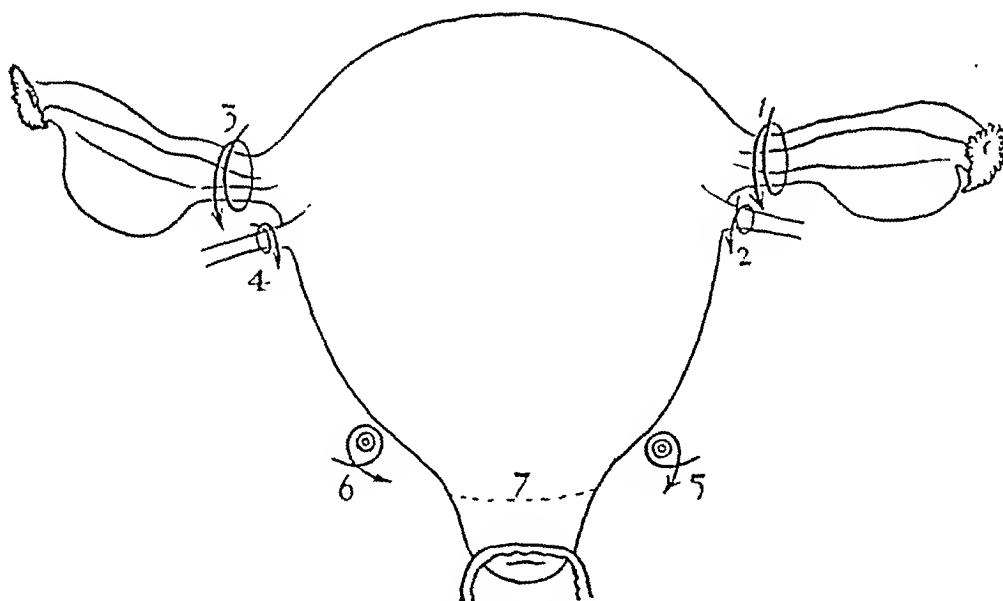


FIG. 406.—CLASSICAL SUPRAVAGINAL MYOMECTOMY.

Releasing uterus from broad ligament attachments in order indicated by ligating and severing connection at 1 (left tube and ovary), 2 (round ligament), 3 (right tube and ovary), 4 (right round ligament), then ligating left uterine artery (5); ligating right uterine artery (6), and finally, amputating supravaginally (7).

amputation of the uterine body, and with panhysteromyomectomy, the removal of the entire uterus. In myomectomy, the defect created by the abstraction of the tumor from its bed is closed by sutures uniting the base and the edges of the wound so as to leave a normal uterus functionally perfect. Abdominal myomectomy is one of the most actively conservative of all operative procedures and is the counterpart on the peritoneal side of the vaginal extirpation of submucous myomata.

Indications.—Myomectomy is especially adapted to the treatment of single or several isolated tumors in younger women, so disposed that they can be readily excised or shelled out without undue sacrifice of uterine tissue. It should, therefore, be elected, with reservations, as the treatment *par excellence* of isolated pedunculate, as well as of many isolated sessile, interstitial, or broad ligament growths. I have treated in this way a uterus containing as many as nine myomata, each removed through a separate incision, and, again,

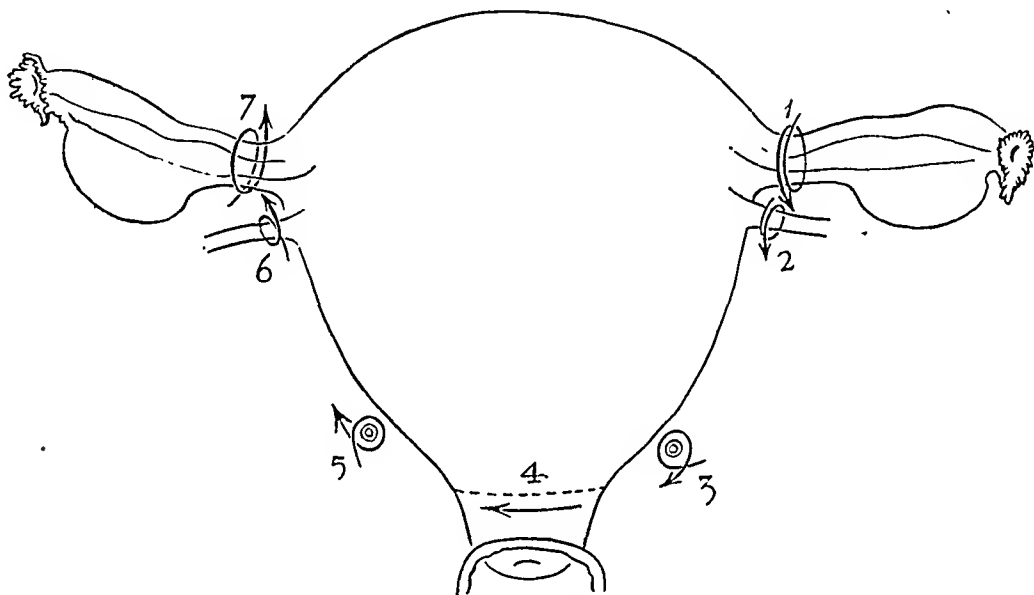


FIG. 407.—SUPRAVAGINAL AMPUTATION BY CONTINUOUS LIGATION AND DIVISION DOWN ONE SIDE (IN DIAGRAM BEGINNING AT LEFT CORNU), AMPUTATING ACROSS CERVIX (4), AND FINISHING BY LIGATION AND DIVISION UP RIGHT BROAD LIGAMENT.

In event of troublesome adhesions on one side, begin with opposite, where structures are freer.

another containing twelve. In two instances, I successfully removed a tumor as large as a man's head.

The supreme result of a myomectomy lies in the pregnancy which may follow, as has occurred repeatedly even following the enucleation of a large growth. One patient, an army officer's wife well up in the thirties, who had never been pregnant, had a child within eighteen months after the removal of a large growth.

J. M. Hundley removed five myomata, the largest about 10 centimeters in diameter in the anterior wall of the uterus and all partly interstitial, the fundus of the uterus reaching nearly up to the umbilicus. During the operation, the uterine cavity was opened. Following this, in two years, she bore a child.

It must be clearly recognized that when the growths are multiple and some of them small, the patient is likely to turn up again in a few years with another crop. It is wiser, therefore, generally speaking, to avoid multiple myomectomies!

With a large tumor, the difficulties of closing the wound enhance the risk. On account of the loss of blood and the duration of the operation, as well as a liability to postoperative hemorrhage, myomectomy even in expert hands may entail more risk than hysteromyomectomy.

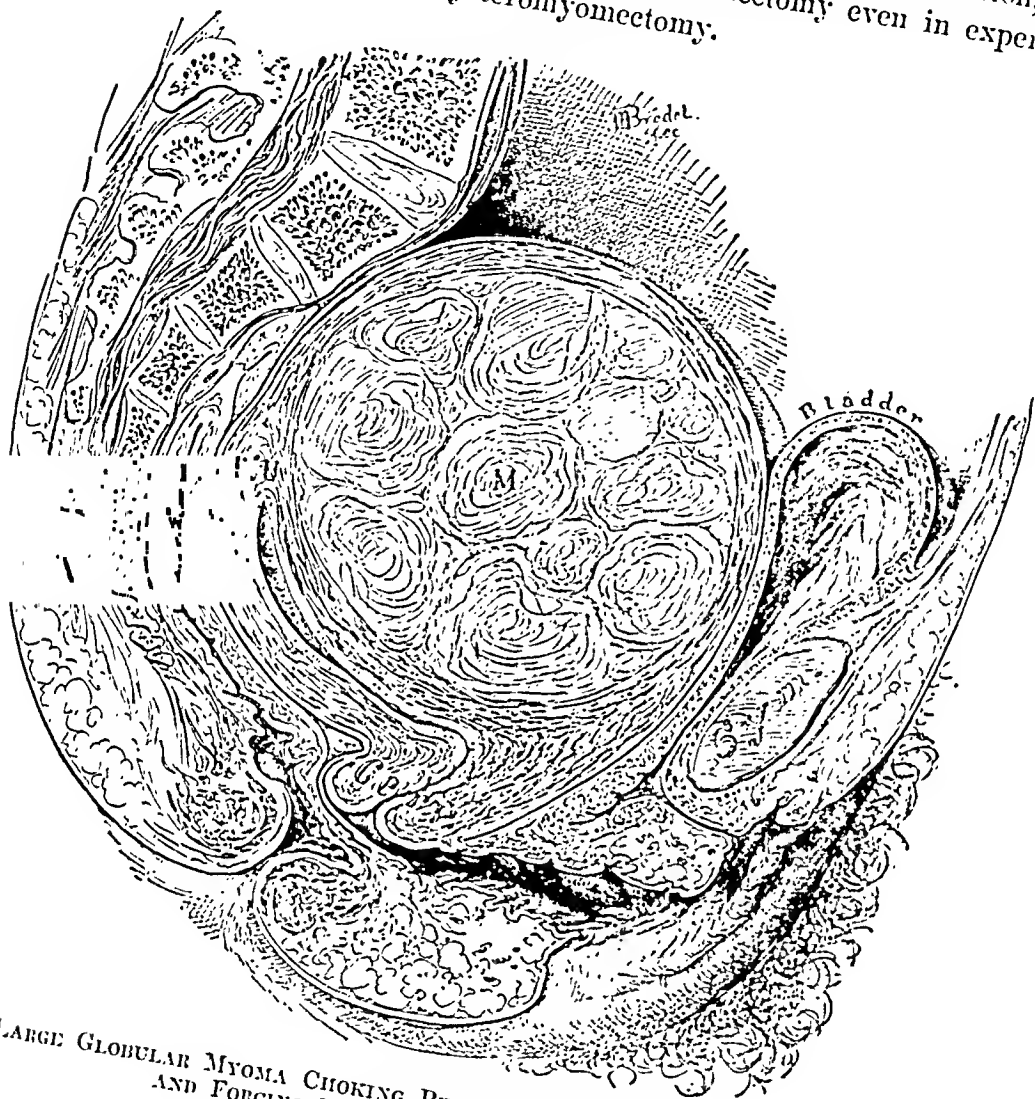


FIG. 408.—LARGE GLOBULAR MYOMA CHOKING PELVIS, COMPRESSING RECTUM AND BLADDER, AND FORCING BLADDER UP INTO ABDOMEN.
Note retroflexion of uterus. About $\times \frac{1}{2}$.

Small tumors, such as are found incidental to another operation, up to 2 centimeters in size, are well treated by plunging the electrocoagulation needle into each one, using a relatively strong current to destroy its vitality and leaving it to be absorbed.

Myomectomy is suitable in:

1. Single and discrete tumors
2. Pedunculate myomata
3. Well-outlined single subserous or interstitial myomata
4. Multiple small myomata (electrocoagulation preferable)

5. Some broad ligament myomata
6. Some submucous myomata too large for vaginal extraction
(August Martin)



FIG. 409.—SAME MYOMA LIFTED UP INTO ABDOMEN OUT OF ITS BED, SHOWING HYPERTROPHY OF ANTERIOR UTERINE WALL, AND COMPLETE DETACHMENT OF BLADDER FROM UTERUS AND UPPER VAGINA. NOTE COMPRESSION OF RECTUM.

Much can be done beforehand to determine whether myomectomy or hysteromyomectomy is advisable. Where, for example, the rectal, vaginal, and abdominal examinations show that the tumor springs from a uterus of normal size by a pedicle and no other tumors are found, the surgeon will give the reasonable assurance that there will be no mutilation. The expectation is also justified when a single myoma is found before or behind the uterus and the

uterine canal is not much lengthened. One of the most promising signs is a uterus of a subspherical form with no other nodules.

Operation.—The general principles governing the operation are:

1. Good exposure of uterus and tumor through a liberal abdominal incision.
2. Isolation of the tumor (brought outside if possible), surrounded with gauze.

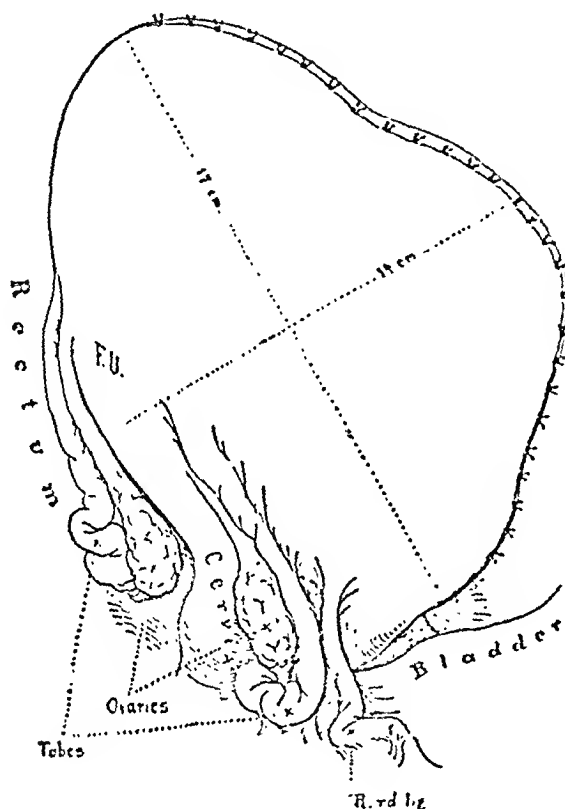


FIG. 410.—UTERUS AFTER EXTIRPATION OF MYOMATOUS TUMOR.

Great muscular hypertrophy, measuring, when returned to abdomen, 14 × 17 centimeters. A row of twenty-nine sutures used in closing incision in uterine wall. × $\frac{2}{3}$.

3. Incision around the pedicle or through the capsule, exposing the tumor.
4. Temporary complete control of hemorrhage by clamps and by compression of the main vascular trunks, by a rubber or gauze tourniquet around the cervical portion of the uterus.
5. Enucleation of the tumor from its bed, catching all bleeding vessels.
6. Permanent control of hemorrhage by ligatures to larger vessels and by electrothermic coagulation, as well as by buried sutures closing the wound. If necessary, the uterine arteries can be ligated.
7. Sung closure of the uterine incision with careful attention to the ends, seeing that no hemorrhage continues between the sutures.
8. Relaxation of the tourniquet on the vessels and observation for some minutes to note any hemorrhage.

9. Closure of the abdominal incision with a small telltale drain, dropped just into the peritoneal cavity, as an indicator in case of hemorrhage which is the one great danger.

The table should be dropped level some time before closing the abdominal incision.

A case in which another tumor grew is shown as it appeared five years later, Figures 410 and 411.

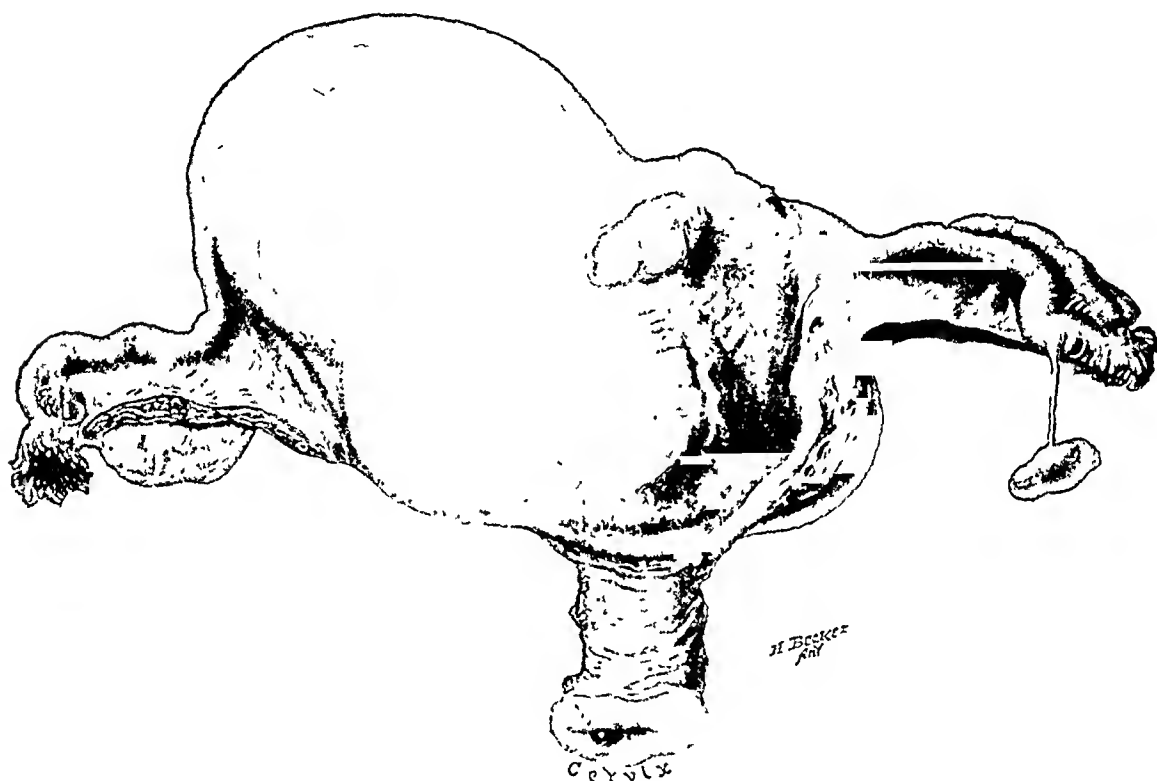


FIG. 411.—DEMONSTRATES POSSIBILITY OF FAILURE THROUGH RETURN OF FIBROID TUMORS. SAME CASE AS IN FIGURE 410.

Recurrent myoma resembling uterus bicornis, accessory fimbriated extremity on right tube; left ovary turned up and adherent to tube. Cervical polyp. Recovery.

In the enucleation, a bold linear incision is made through the investing muscularis well into the white tissues of the tumor which is grasped by a stout museau forceps and elevated as the enveloping muscularis is worked back by blunt dissection and the tumor shelled out of its bed, Figures 412, 413, and 414. No harm is done by opening the uterine cavity which is closed with a fine interrupted chromic suture.

In one instance, the entire uterine mucosa of the anterior wall was torn from cervix to fundus, in the form of a triangular flap which was closed with a delicate catgut suture without in any way affecting the recovery.

It is also necessary at times to resect a considerable part of the uterine mucosa.

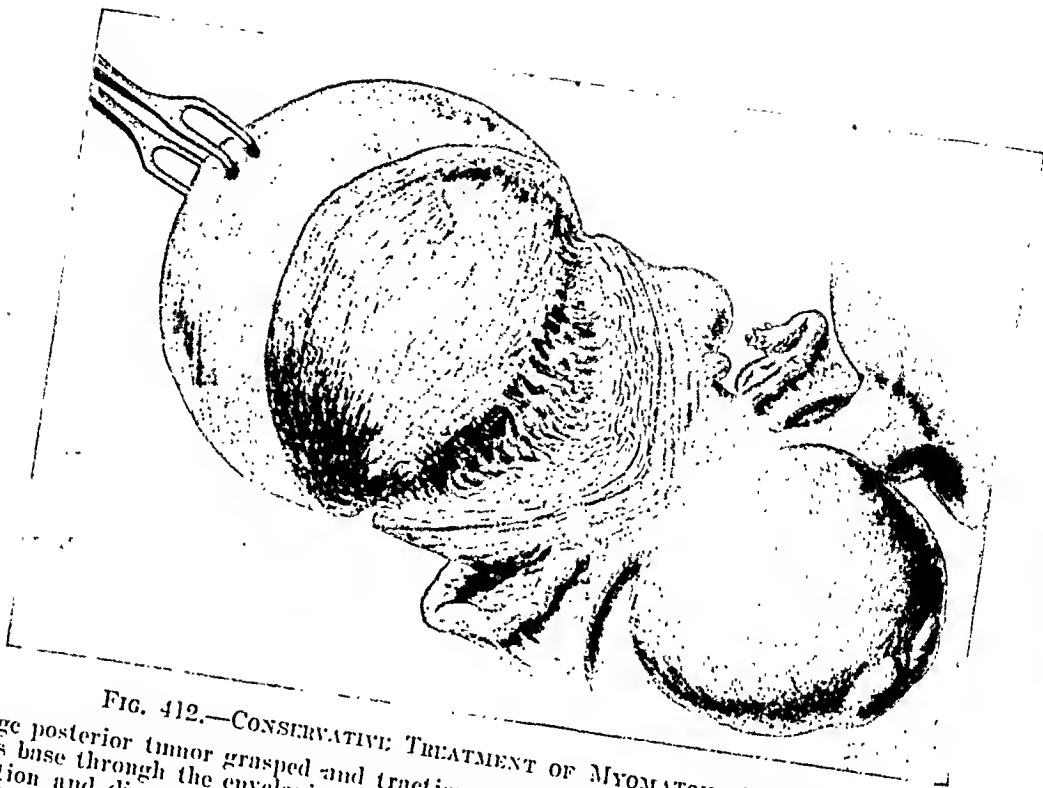


FIG. 412.—CONSERVATIVE TREATMENT OF MYOMATOUS UTERUS.

Large posterior tumor grasped and traction made, while an oval incision is made not far from its base through the enveloping uterine wall down to the tumor, shelled out of its base by traction and dissection. Such a case is not one in which to elect myomectomy. It is better also to slit encapsulating uterine muscle and extract the tumor.

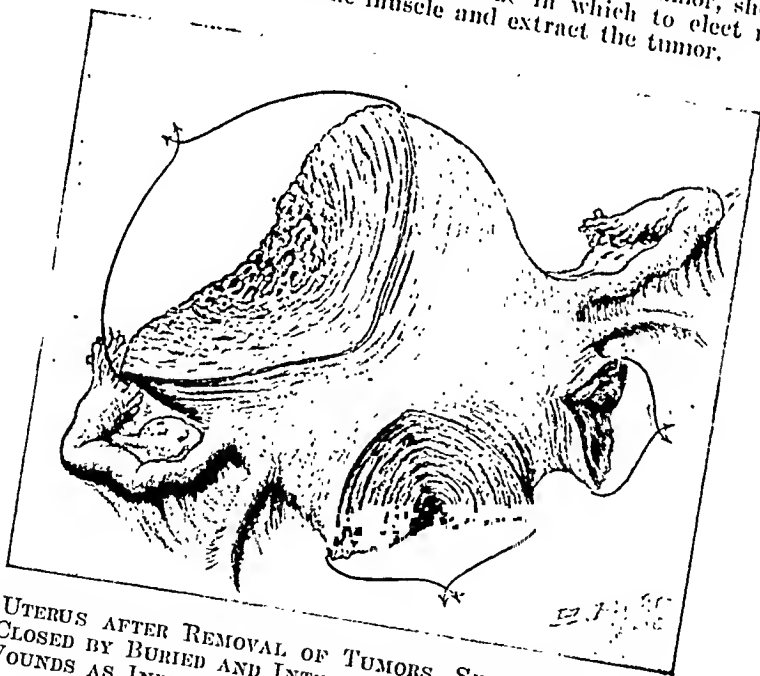


FIG. 413.—SAME UTERUS AFTER REMOVAL OF TUMORS, SHOWING BROAD BASES OF UTERINE TISSUE TO BE CLOSED BY BURIED AND INTERRUPTED CATGUT SUTURES, APPROXIMATING THE LIPS OF THE WOUNDS AS INDICATED BY CROSSED ARROWS.

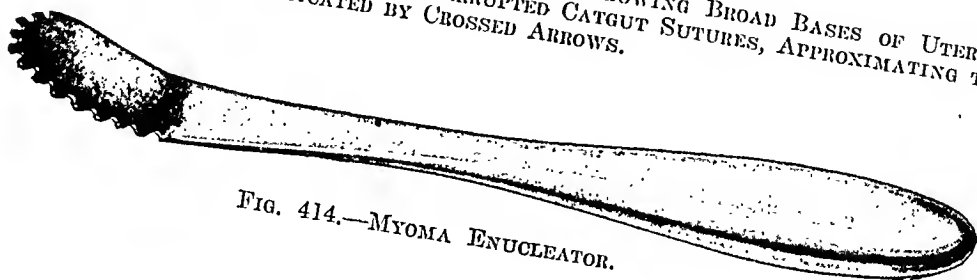


FIG. 414.—MYOMA ENUCLEATOR.

In closing the uterine wound, every effort must be made not to leave any dead spaces.

A big tumor is often best removed by bisecting it until its opposite periphery is reached, when each half is enucleated separately in a direction from the opposite pole outward.

The uterine structures must not be handled more than necessary.

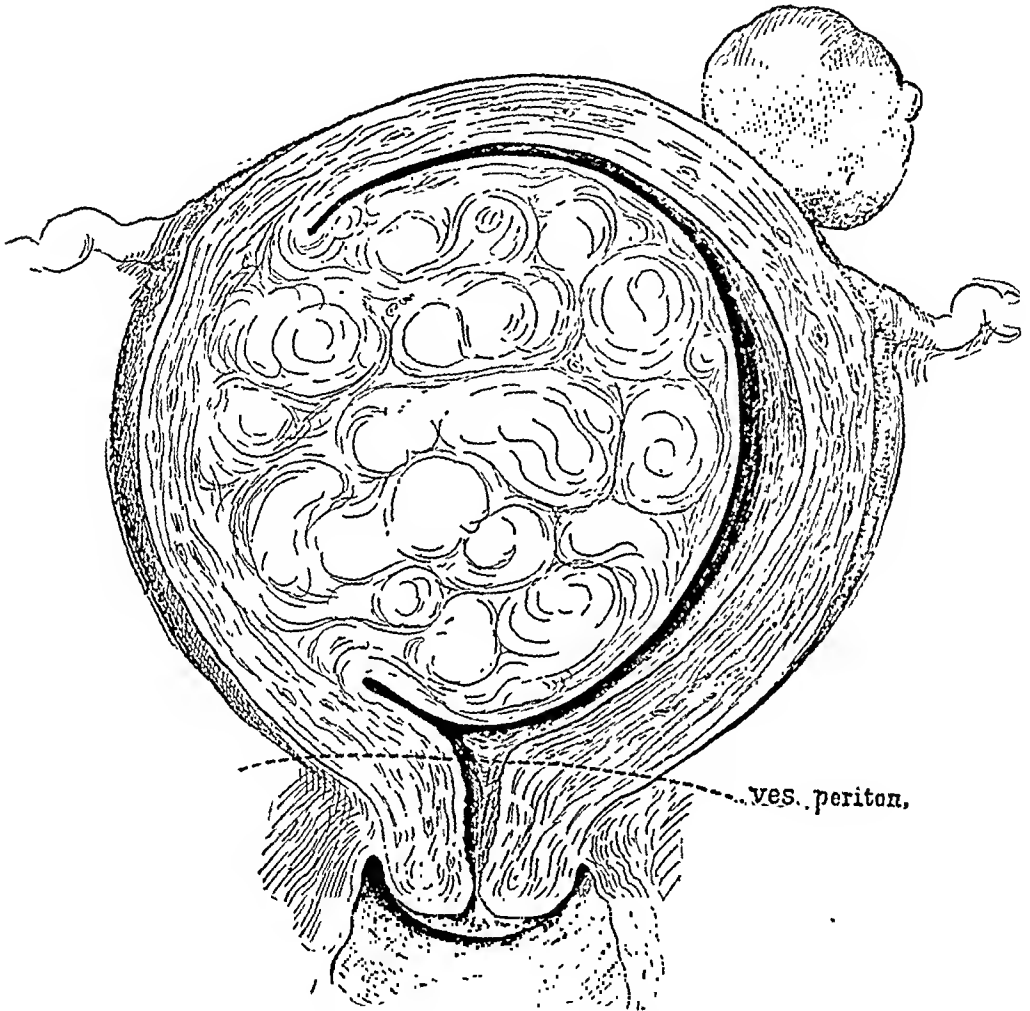


FIG. 415.—LARGE SUBMUCOUS MYOMA.

Adapted to myomectomy by abdominal section, splitting open uterus and enucleating tumor, and sewing up uterine incision. $\times \frac{2}{3}$.

By reason of its hypertrophy, the reconstructed uterus often presents a massive, irregular, bizarre appearance, Figure 410.

A sloughing fibroid ought not to be removed *per vias abdominales* if it can be avoided; if it becomes imperative, then every effort should be made to take out the whole uterus with the cervical end clamped to shut in the discharges, while the vagina is cleansed sedulously and dried out before amputating it. A liberal pelvic drain must be left in the vagina and gloves and instruments should be changed before closing the abdominal incision.

I was an interested visitor at the private clinic of A. Martin of Berlin, when he extended the field of abdominal myomectomy by removing a large submucous myoma by an abdominal hysterotomy (*Centralbl. f. Gynäk.*, July 31, 1886). I have removed a smaller one about 2.5 centimeters in diameter found in an exploratory hysterotomy. For such work, the vaginal route is preferable.

HYSTEROMYOMECTOMY

Hysteromyomectomy commonly designates the removal of the tumors with the body of the uterus amputated in its cervical portion—more precisely supravaginal hysteromyomectomy.

In the history of this beneficent operation, there is much that is creditable to American surgery as developed in the historical studies of E. W. Cushing (*Ann. Gynäk. & Pediat.*, 1895) and C. P. Noble (*Am. J. Obst.*, 1899, 40).

W. L. Atlee operated successfully in 1844 (*Am. J. M. Sc.*, 1845, and his prize essay, "The Surgical Treatment of Certain Fibrous Tumors" (*Tr. Am. M. Ass.*, 1853). John Bellinger in 1846 did the first deliberate hysteromyomectomy (*South. J. M. & Pharm.*, 1847) through a long incision, using animal ligatures; the patient died of peritonitis on the fifth day. Walter Burnham of Lowell, Massachusetts (June, 1853), operated, expecting to remove an ovarian cyst but found a fibroid which was extruded by vomiting; as it could not be returned, he removed it with the ovaries at the cervix, and the patient recovered. This was followed by a second and a third operation in 1854 and 1857 (*Tr. Am. M. Ass.*, 1878). C. Kimball of Lowell (September 1, 1853), operated deliberately and successfully for a fibroid tumor (*Boston M. & S. J.*, May, 1855) and, according to Bigelow, in 1883, performed eleven hysteromyomectomies with six recoveries and five deaths.

H. O. Marey devoted particular attention to the treatment of the cervix and sewed the pedicle with the cobbler's stitch (*Tr. Am. M. Ass.*, 1882).

T. A. Emmet, in 1884 (*Principles and Practice of Gynecology*) utilized the vesical peritoneum to cover the cervical stump in an operation for a dermoid cyst and a fibrocystic uterus, and in discussing the operation this important advance by retroperitonealization is pointed out.

M. A. D. Jones, February 16, 1888, did the first panhysterectomy in America for a uterine fibroid (*N. York M. J.*, Aug. 25, and Sept. 1, 1888), independently of Bardenheuer whose work was not known here.

J. Eastman's name is indelibly associated with panhysterectomy, performing his first operation in 1889 (*Indiana M. J.*, 1890, and *Med. Fortnightly*, Jan. 15, 1896).

Undoubtedly the most revolutionary advance was that of L. A. Stimson of New York, who signalized the cardinal point in the deliberate individual ligation of the two ovarian and the two uterine arteries in their course as simplifying and insuring the safety of the procedure (*N. York M. J.*, March

9, 1889, and *Med. News*, July 27, 1889), avoiding the dangerous broad ligament mass ligatures with the attendant risks of sepsis and hemorrhage.

While thus giving credit to American effort, one must also recognize the admirable work of such distinguished surgeons as Velpeau, Amussat, Bardenheuer, Schröder, Martin, Zweifel, Chrobak, Sänger, Fritsch, and finally Olshausen (Veit's *Handbuch*, 1897). In England, the names of Keith, Thornton, Bantock, Milton of Cairo, and Heywood Smith are indelibly associated with the evolution of hysterectomy.

Indications.—The indications for hysteromyomectomy are, in general:

1. Discomfort or ill health produced by the tumor interfering with occupation or comfortable getting about.
2. Size of tumor, more or less filling the lower abdomen or choking the pelvis.
3. Rapid growth.
4. Excessive hemorrhages, but usually relievable by ray therapy.
5. Severe pain, often associated with attacks of peritonitis, significant of adnexal disease.
6. Various complications—uterine cancer, ovarian cysts, dermoid cysts, pus-tubes.

I have operated a few times solely on account of the persistently distressed mental attitude of the patient, which I dub "onkophobia," or tumor fear.

Anemia is often a source of anxiety, as one so frequently sees women who have been bled white. Experience, however, shows that the operative risk is not greatly enhanced (*Johns Hopkins Hosp. Bull.*, Nov. 1904). In twenty-three, there were but two deaths: One had a hemoglobin of 20 per cent with broken cardiac compensation, coupled with a bleeding sloughing myoma, and the other died from the anesthetic; six had a hemoglobin below 30 per cent, and two were as low as 22 per cent—all did well. In spite of these excellent statistics, it would be well with a hemoglobin 40 per cent or lower to give a transfusion of from 500 to 700 c.c. before, during, or after operation. Fortunately, just here ray therapy is most effective and should be used first. If operation is imperative, one or more transfusions will aid greatly.

Operation, Including Utriculoplasty, Bisection, and Panhysteromyomectomy.—The steps in the operation are:

1. Preliminary preparation of field, including skin and vagina.
2. An incision long enough to work rapidly and unhampered.
3. Delivery of the tumor out on the surface if possible.
4. Proximal ligation of ovarian vessels and round ligaments of one side, say the left, clamping the structures distally and cutting between.
5. Detachment of the vesico-uterine fold of peritoneum from the cervix from side to side but not separation of bladder from cervix unless imperative.

6. Ligation of the left uterine vessels.

7. Amputation of the uterus from left to right in the cervical portion, forming a cupped pedicle.

8. Clamping the uterine artery of the opposite right side well above the level of the divided cervix.

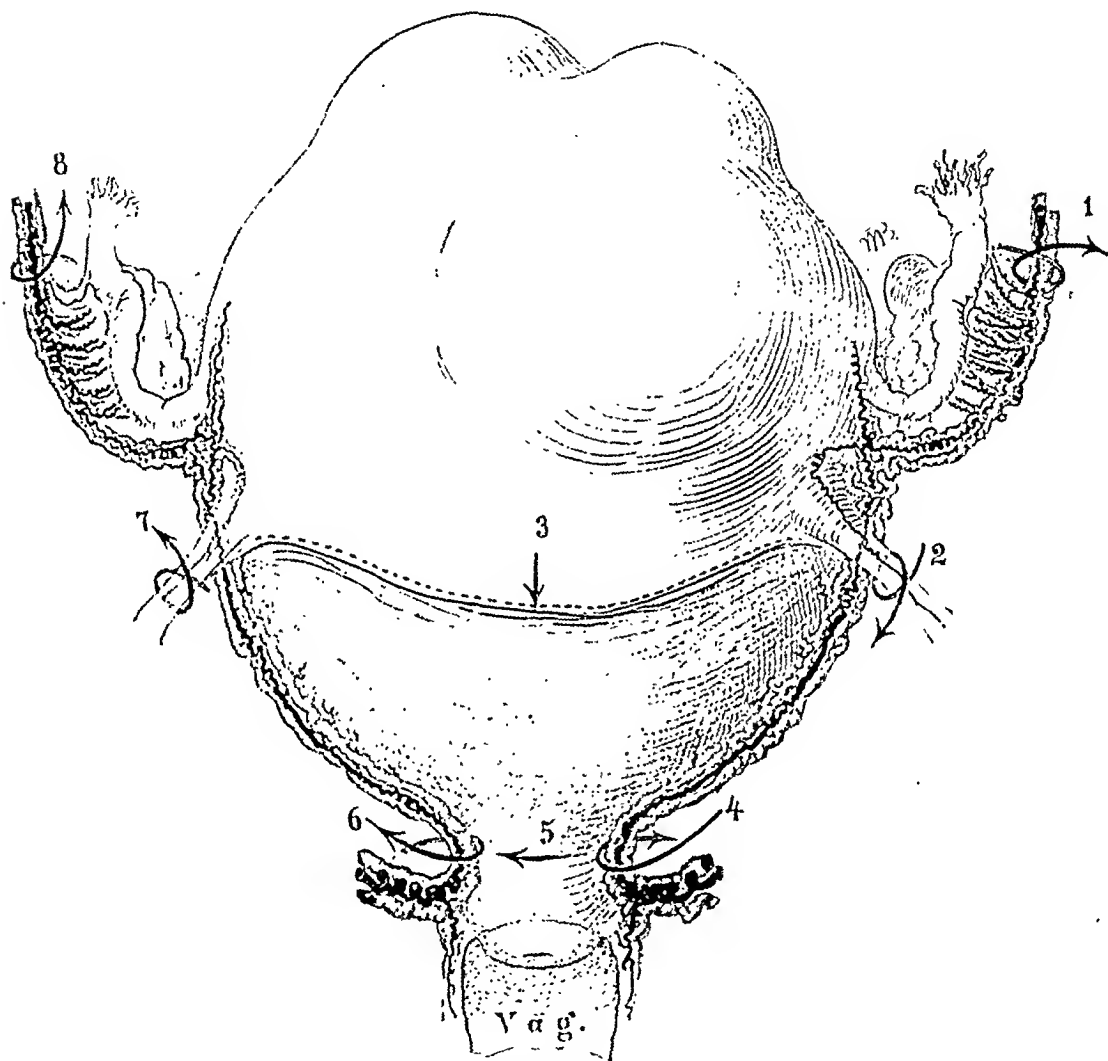


FIG. 416.—REMOVAL OF FIBROID UTERUS WITH TUBES AND OVARIES.

Ligatures applied following numbered arrows. 1 encircles ovarian vessels in infundibulopelvic ligament. 2 controls left round ligament, caught with forceps but not tied. 3. Bladder is pushed down as far as cervix if necessary. 4 controls left uterine vessels. 5. Cervix amputated. 6. Exposed right uterine vessels controlled at point above cervix. 7. Right round ligament clamped. 8. Mass inverted and removed, while clamping right ovarian vessels.

9. Clamping the right round ligament and ovarian vessels, followed by the removal of the mass.

10. Application of ligatures in place of forceps, a step omitted by tying instead of clamping.

11. Closure of the cervical stump with the implantation of the round ligaments in the angles.

12. Covering the stump with peritoneum (extraperitonealization).
13. Closure of abdominal incision without drain.

In a woman under forty, it is well to leave both ovaries with or without the uterine tubes, in order to escape the discomforts of an artificial menopause.

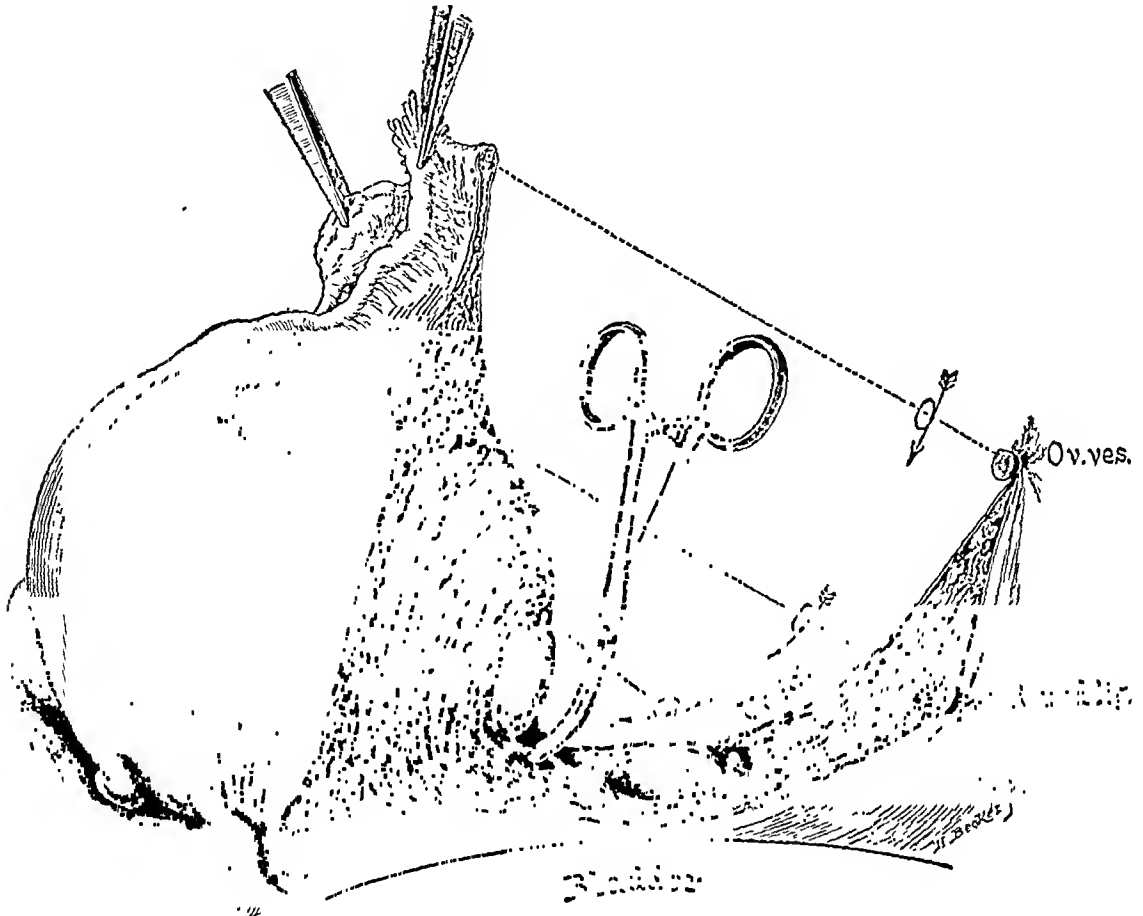


FIG. 417.—HYSTEROMYOMECTOMY.

By continuous incision from left to right, ligating or clamping at points indicated by arrows; first, left ovarian vessels (*Ov. ves.*), next, round ligament; then, left uterine artery (*Ut. Art.*). Finally, cervix is cut across, and uterus pulled away until right uterine vessels are exposed; these should be caught at a point higher than indicated.

Death from the operation may be caused by pulmonary embolism, due to the liberation of a clot forming in an iliac vein, which is swept up into the pulmonary artery—an unavoidable accident with an average frequency of about 0.5 per cent; peritonitis, rare in the absence of a complicating bad infection in the tumor, for which vaginal drainage is a prophylactic; postoperative hemorrhage, which ought to be exceedingly rare and is due to faulty technique; intestinal obstruction, arising from adhesions between bowel and intestines or anterior wall and more apt to occur with an extensively adherent tumor which leaves raw surfaces behind.

Excessive hemorrhage during the operation should not occur.

When large tumors lie in the body of the uterus below the fundus, the

growing mass continually lifts the lateral structures higher into the abdomen, and as the broad ligaments ascend vertically they appear at first sight to be absent and replaced by a number of large vessels spread fanwise over the mass and difficult to attack. Closer inspection, however, usually shows the vessels tending to group together at the pelvic brim where they can be exposed by pulling the uterus well over to the opposite side. Here, then, low down

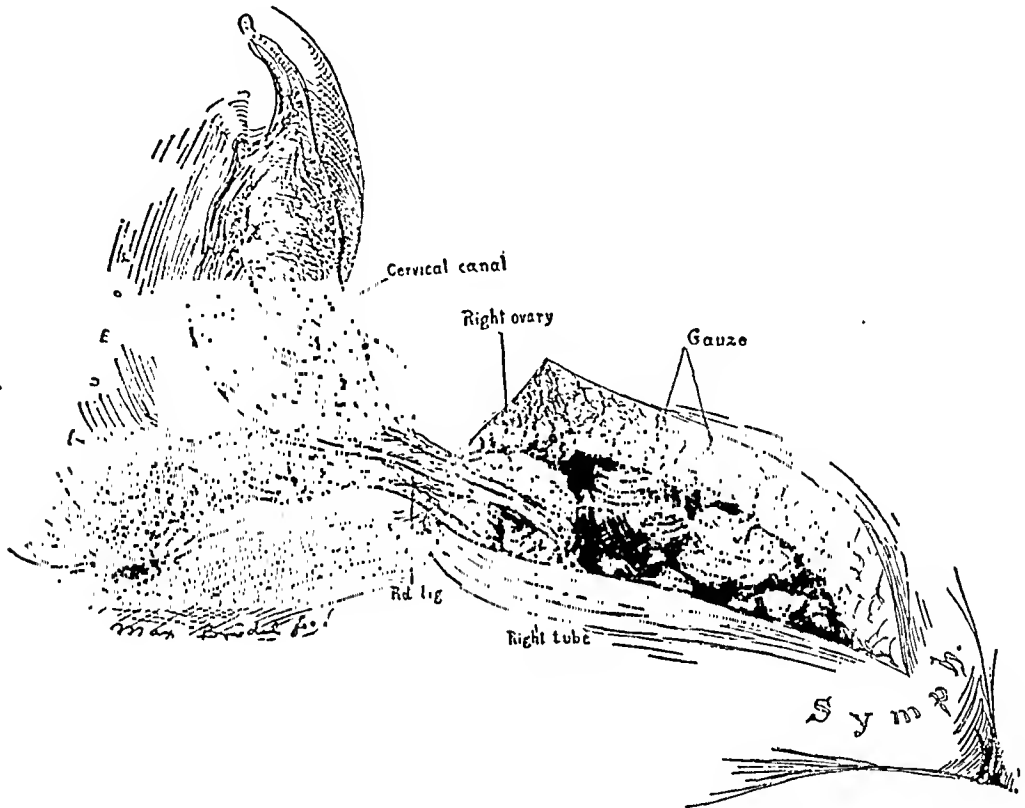


FIG. 418.—LAST STEP IN ENUCLEATION OF MYOMATOUS UTERUS.

Mass rolled out of abdomen is attached only by round ligament, ovary, and tube.

laterally, they are picked up and tied doubly with fine silk ligatures and divided. This opens up a cellular interval in which the process of stripping the loose peritoneum from the tumor mass begins and is easily continued step by step.

If the sigmoid flexure is elevated high out of the pelvis on the tumor, it may be necessary to split the mesosigmoid on its outer side and then to push the peritoneum down before the ovarian vessels can be exposed and tied. The utmost care must be taken throughout, first to see and then not to injure a ureter.

Utriculoplasty.—It was more important twenty years ago before the advent of radium and x-ray therapy to know that in young women whose chief complaint was hemorrhage occasional hysteromyomectomies could be done, leaving in one or both ovaries and a modicum of the uterine mucosa to perpetuate the

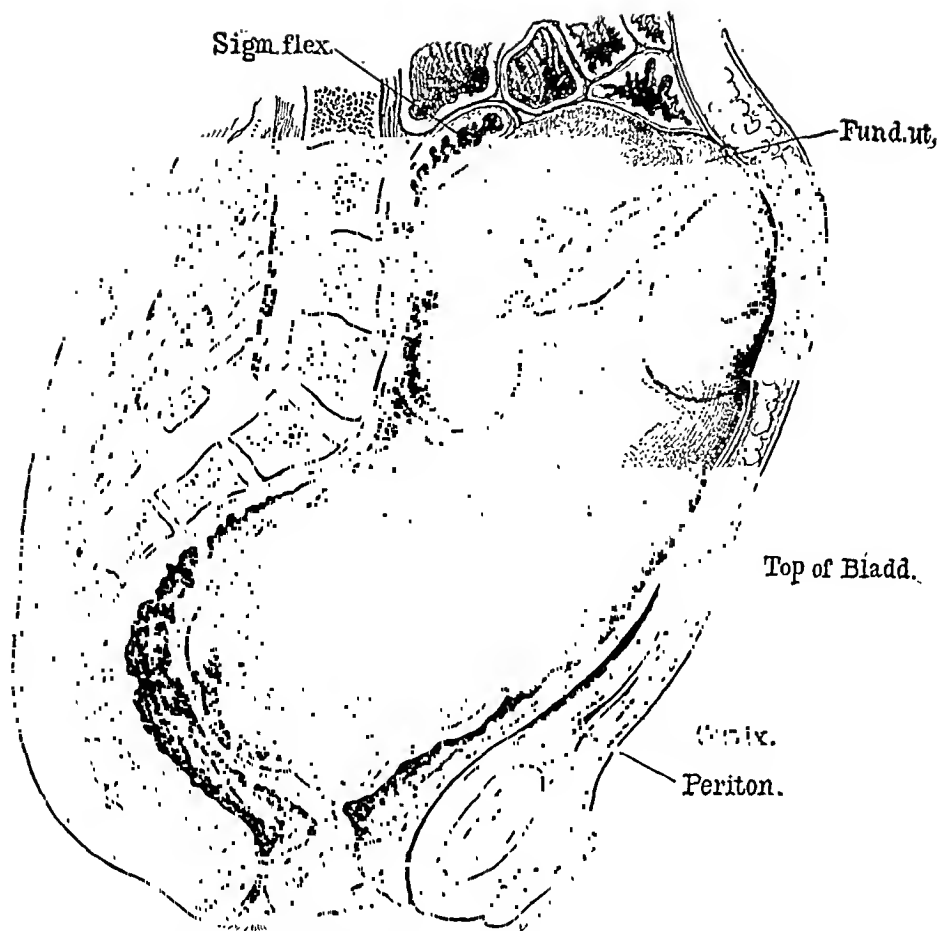


FIG. 419.—COMPLICATED HYSTEROMYECTOMY SHOWING EXTENSIVE SUBPERITONEAL DEVELOPMENT.

Cervix raised high out of pelvis, and bladder drawn up into abdomen. Fundus uteri high above umbilicus opposite displaced sigmoid flexure. Line of reflection of peritoneum over side of tumor shown. Hysteromyectomy. Recovery.

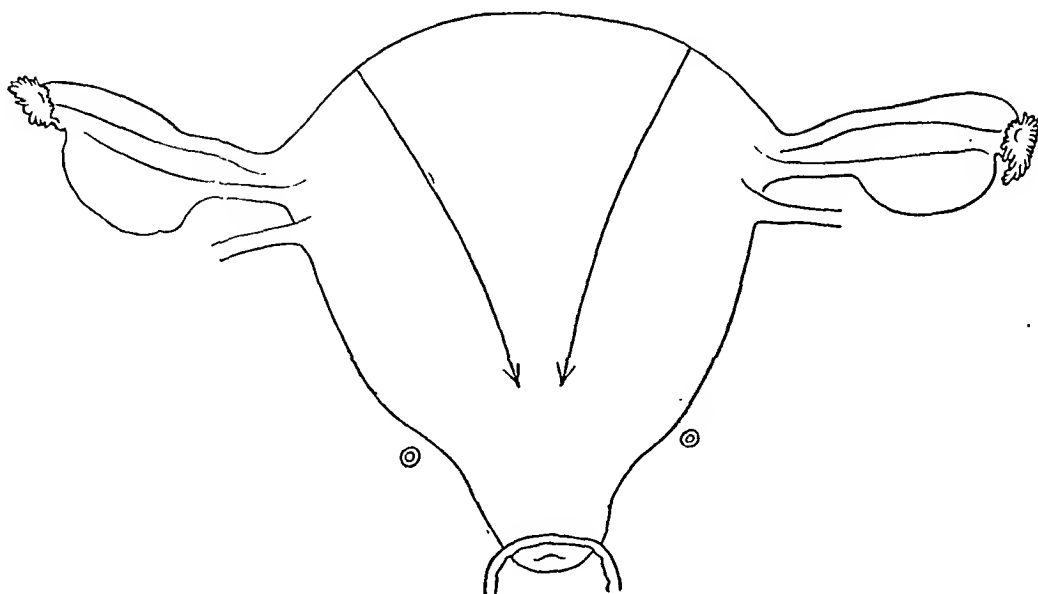


FIG. 420.—UTRICULOPLASTY.

Excision of wedge of body of uterus to form a utriculus.

menstrual function. This was only possible when the tumor or tumors were situated on the upper part of the uterine body and the lower portion was absolutely free. The amputation was made as well above the cervix as seemed advisable and the vascular anterior and posterior walls then sutured together. The tubes, of course, were not connected with the diminutive uterine cavity.

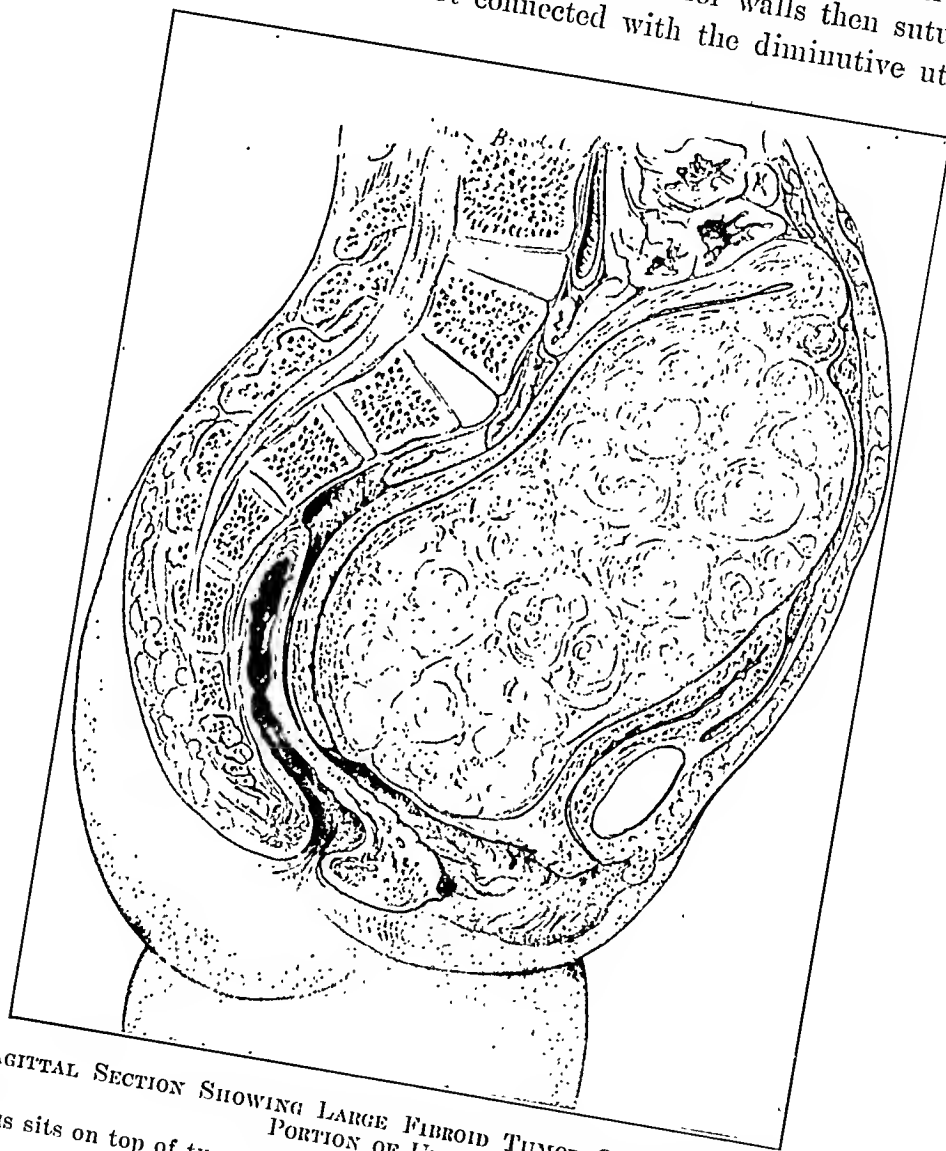


FIG. 421.—SAGITTAL SECTION SHOWING LARGE FIBROID TUMOR OCCUPYING LOWER ANTERIOR PORTION OF UTERUS.
Fundus sits on top of tumor behind umbilicus; cervical canal extremely long.

Bisection.—In an extreme case, with a high displacement over the convexity and not reachable near the pelvic brim, I have done a bisection with success as follows: The patient, pallid from excessive hemorrhages, had a multinodular fibroid extending up to the umbilicus. The cervix was indistinguishable, and the bladder was half way to the umbilicus and an ovoid fibroid tumor mass occupied the anterior cervical portion, while the body of the uterus sat like a cap on top.

The first effort was to locate and ligate the left ovarian vessels distributed over the posterior lateral convexity; this was impossible on account of hemorrhage as every needle puncture bled excessively. Persistence clearly meant death. I then thrust forceps through the uterine cornua and clamped them to control the vascular channels nearer their source, Figure 422. Then, taking

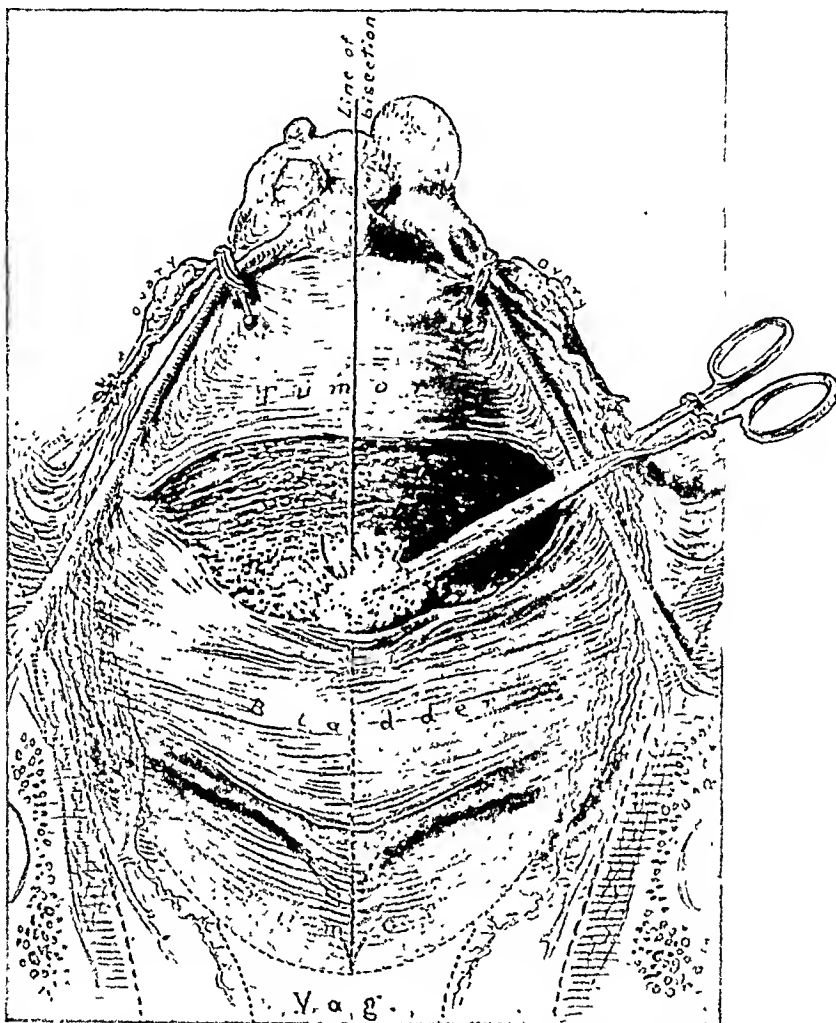


FIG. 422.—LINE OF BISECTION THROUGH BODY OF UTERUS AND TUMOR INDICATED BY ARROW.

Dotted portion below indicates part of bisection completed subperitoneally after pushing down bladder.

a long-bladed knife and grasping each cornu with a stout museau forceps and drawing to the right and to the left, I bisected the anterior face of the uterus in the direction of the arrow, dividing the tumor to the vesical peritoneum which was freed and pushed down. Continuation of the bisection completely divided the tumor vertically and in the median line.

Each half was then enucleated separately by grasping the growth on each side with the strong forceps, lifting it from its bed, and detaching it with a stout crenated spatula. There was no hemorrhage of moment.

With the collapse of the encapsulating uterine tissues, Figure 423, both

uterine arteries were easily reached and conveniently tied well below the body which was then amputated with its thickened muscularis, Figure 424.

Bisection has a wide range of utility in tumors in which the vessels are out of reach or where the tumor is fixed in the pelvis by inflamed uterine tubes. Generally the entire uterine body is bisected with the tumor masses.

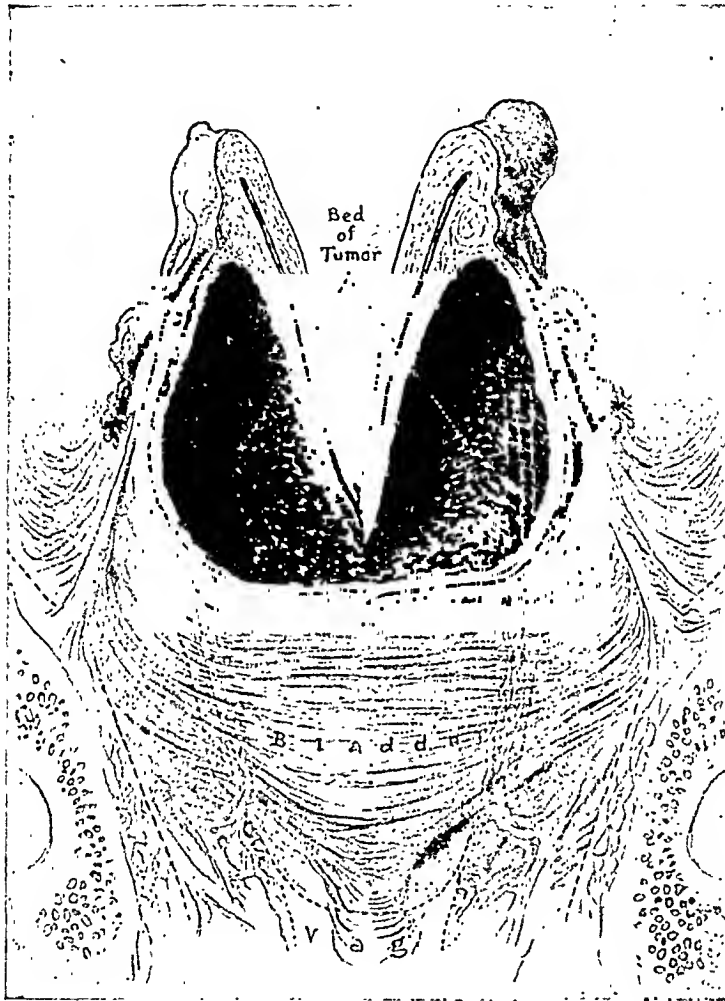


FIG. 423.—UTERUS BISECTED AND TUMOR REMOVED FROM ITS BED.
Uterine vessels now easily accessible.

A large single tumor marked for a myomectomy can also often be handled best in this way.

Bisection is not an operation of choice but of election in hard cases where the lateral or posterior conditions demand it; it enables one quickly to reach and control the uterine vessels and then to work rapidly up the sides and to the ovarian and lastly to deal with the complicating conditions, with the enormous advantages of increased accessibility and constant inspection and the ability to select the best points of attack as they are enucleated.

It is not always without risk, as I learned through the loss of a patient whose tissues were excessively vascular.

Panhysteromyomectomy.—Owing to the occasional subsequent occurrence of sarcoma or carcinoma in the cervical stump, there has been a growing tendency of later years to extirpate the entire uterus with its cervix. This operation is somewhat more awkward and time consuming, unless the uterus and cervix are bisected, than the supravaginal amputation described; it sacri-

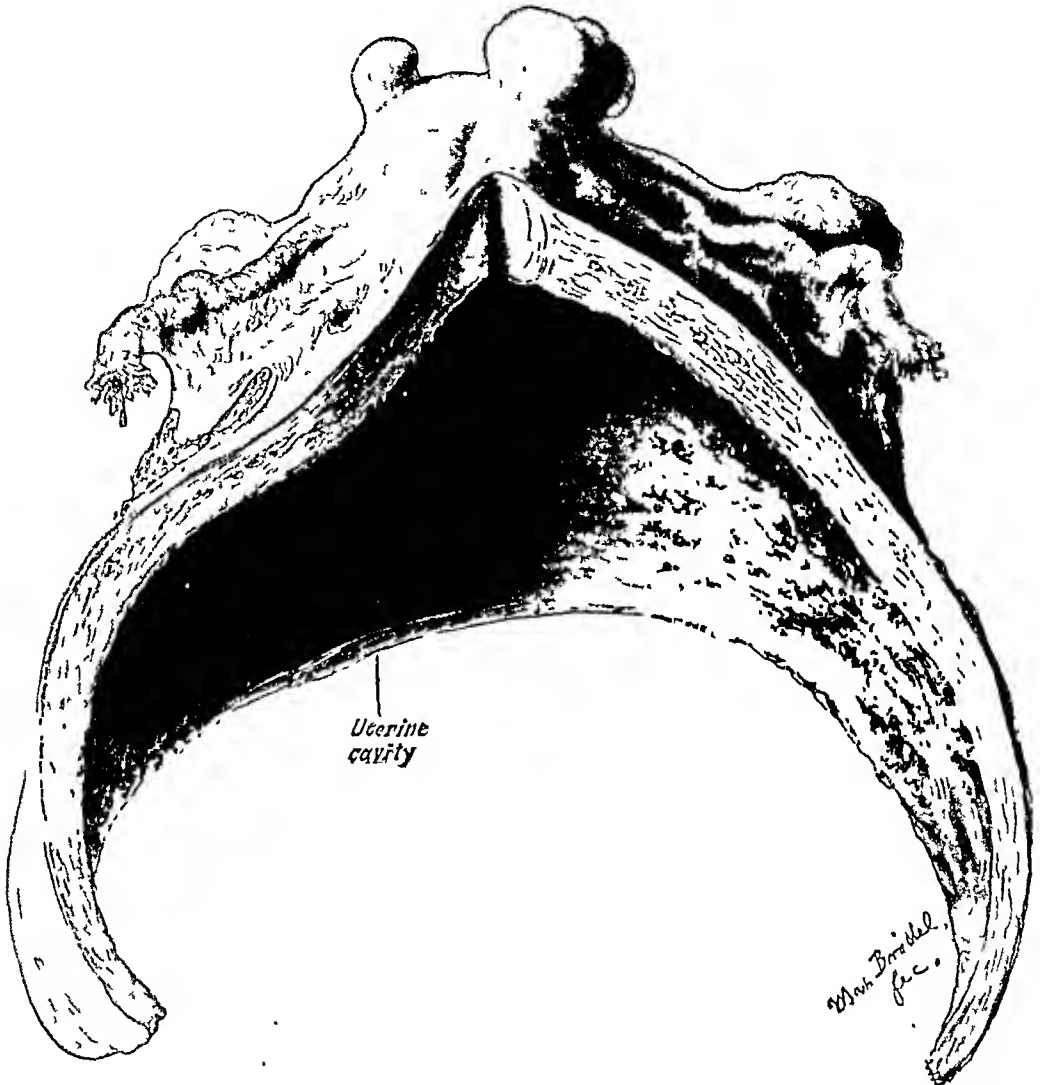


FIG. 424.—UTERINE BODY WITH UPPER PART OF CAP OF TUMOR REMOVED AFTER ENUCLEATION.

fices also the support given by the cervix as a sort of a keystone to the vaginal vault as well as the convenient implantation of the round ligaments in the cervical stump.

I believe it is usually possible to escape these later complications and continue the older method of amputation if we discriminate carefully as to the character of the cervix before operation.

I would, therefore, unhesitatingly amputate above in nulliparæ and women who have normal healthy cervixes, taking care also in the operation to examine carefully for any appearance of a sarcomatous degeneration. And even if the

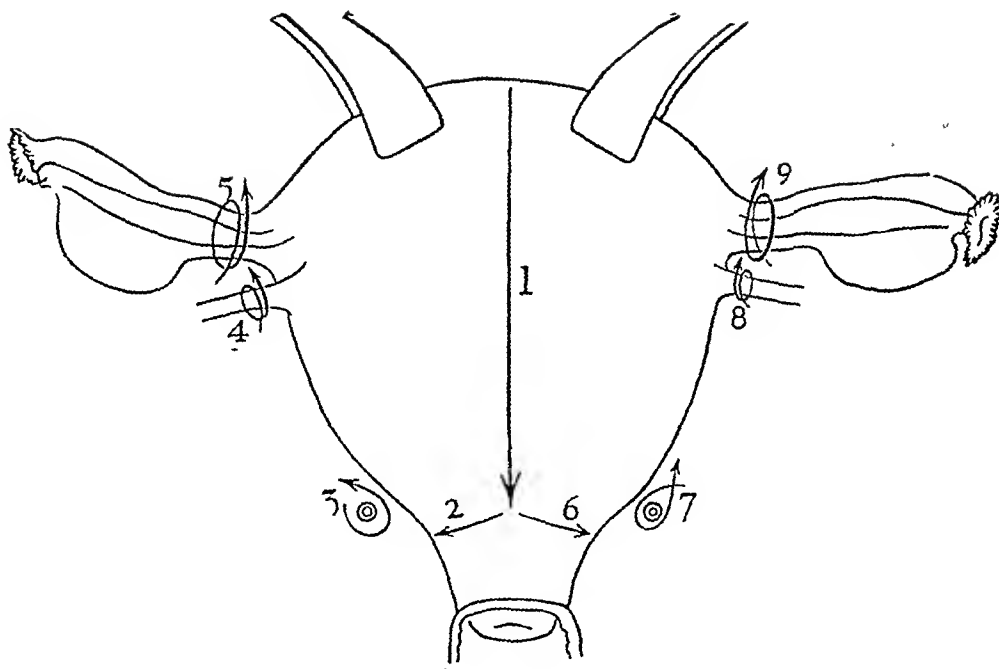


FIG. 425.—BISECTION.

Uterus grasped at fundus with museau forceps. Uterus split down into cervical region, indicated by arrow 1. Right half of cervix divided at 2. Uterine vessels controlled above this level at 3. Round ligament and cornual structures controlled at 4 and 5. Right half of uterus with tumors removed. Cervix grasped with forceps and amputation of left half of uterus with severance of left broad ligament completed as on right side.

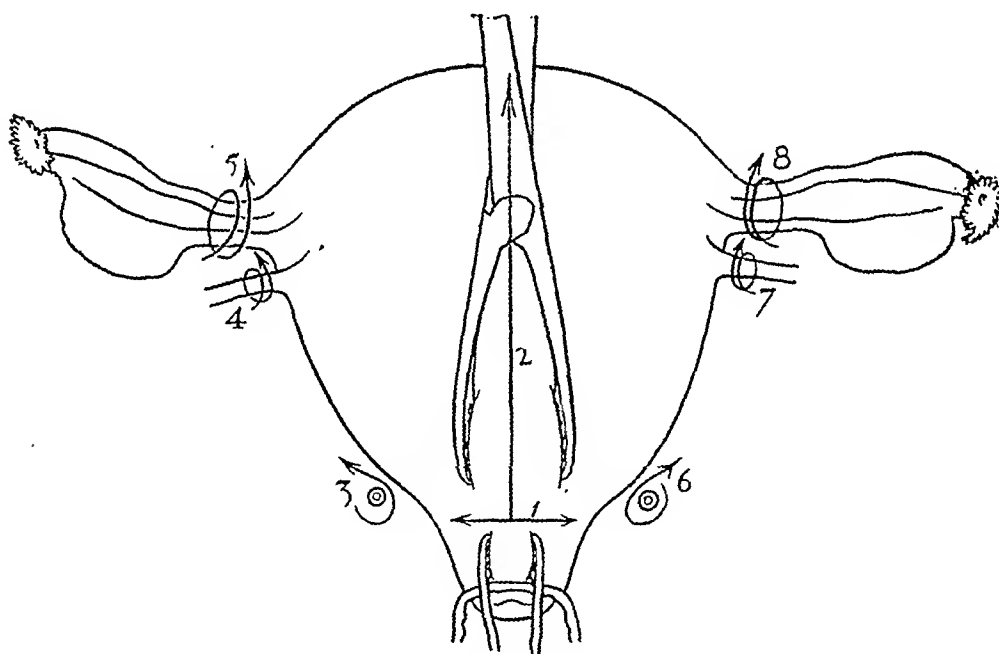


FIG. 426.—HORIZONTAL BISECTION.

Valuable where fundus and lateral structure are buried in dense adhesions. Dissect bladder free and expose cervix. Divide cervix at 1. Bisection usually through anterior and posterior walls in direction from cervix to fundus. When posterior surface is divided, it will be easier to liberate each half in a direction from below upward. Rest of enucleation then follows arrows as numbered.

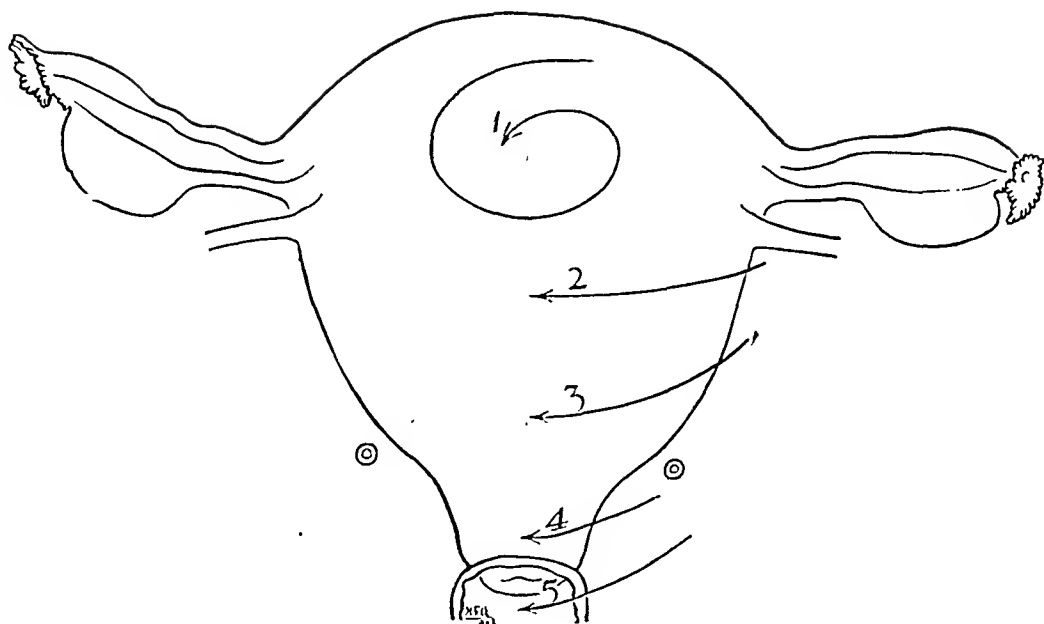


FIG. 427.—AMPUTATION OF UTERUS AT LEVELS 2, 3, 4, 5.

At 2 and 3, uterine tissue with mucosa left to preserve menstrual function with retention of ovaries. 4 represents supravaginal amputation; 5, panhysterectomy; 1, fundal area grasped and removed.

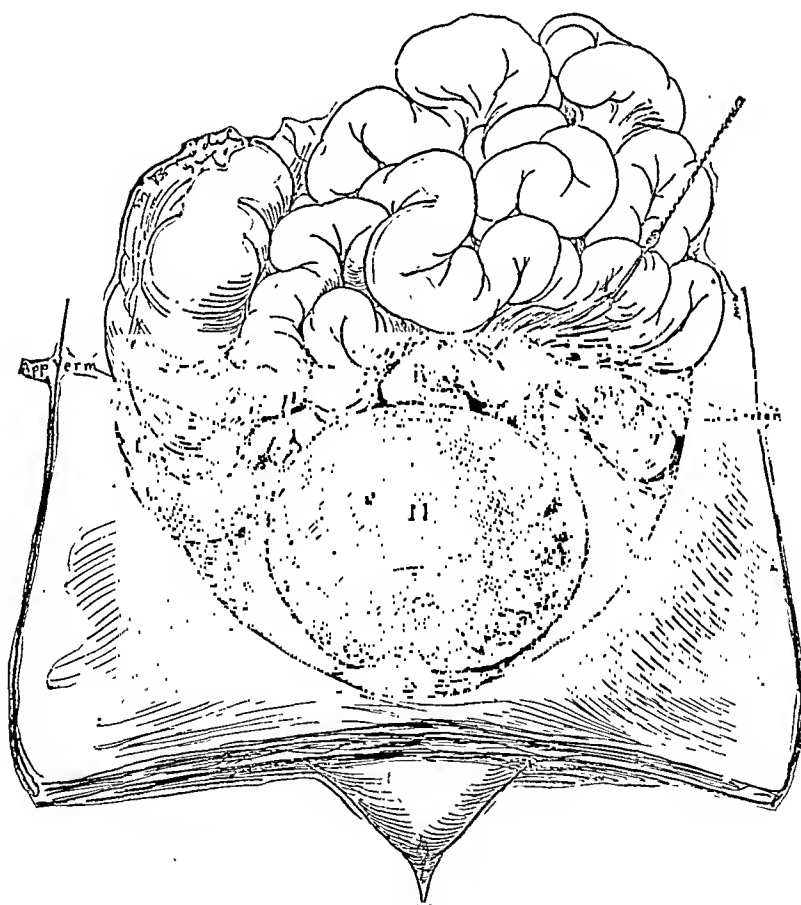


FIG. 428.—PELVIS CHOKED BY CUP-AND-BALL MYOMA (*M*) COMPRESSING SMALL INTESTINES, BLADDER, RECTUM, VERMIFORM APPENDIX, AND URETERS.

cervix shows a moderate degree of cystic degeneration, this could be destroyed either sometime before or soon after the operation by canterization.

The operative procedure is like the supravaginal hysterectomy, down to and including the ligation of the uterine vessels. At this point it diverges and one can either amputate and remove the uterine mass as described and follow this by the enucleation of the cervix as a separate entity, or, again, one can take out uterus and cervix as a whole. In the enucleation of the cervical por-

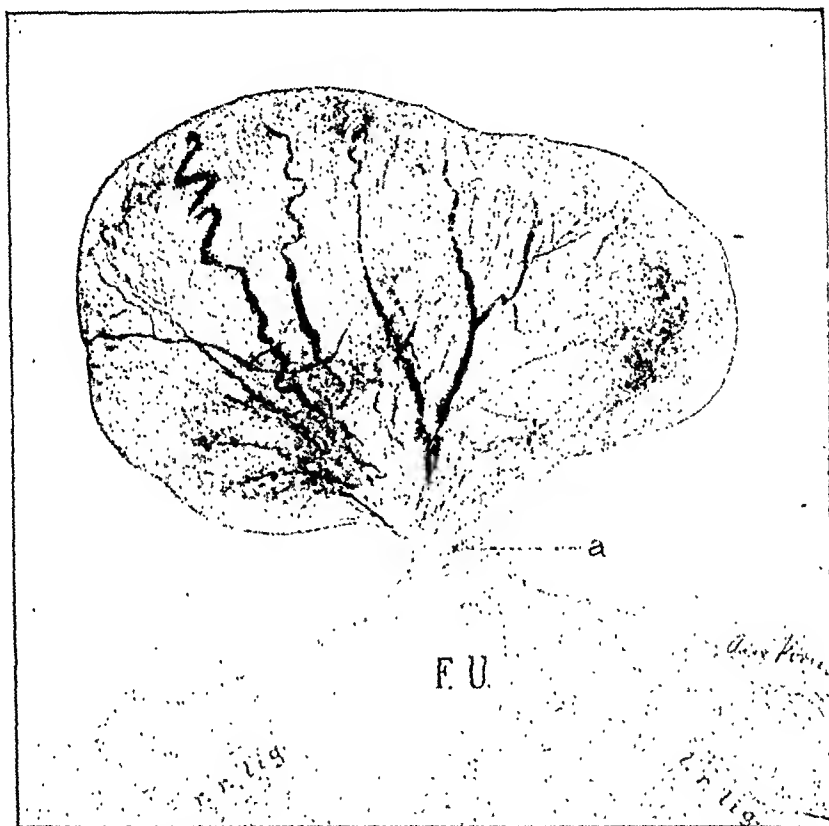


FIG. 429.—TORSION OF SUBPERITONEAL PEDUNCULATE MYOMA SHUTTING OFF BLOOD SUPPLY.

Size of uterus about normal. Right tube and ovary densely adherent. Pedicle (a) made one complete turn. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.)

tion, down to the opening of the vaginal vault, one simply keeps lifting up the uterus and cutting on all sides close to the cervix, skinning it out, as it were, and catching any bleeding vessels. On opening the vagina anteriorly, it is well to insert a loose gauze pack to take up accumulated secretions. The uterus and cervix being removed, actively bleeding vessels are ligated or controlled by coagulation and the round ligaments implanted taut in the angles which are approximated by suture fore and aft, and the rest of the vaginal opening closed and the whole covered extraperitoneally with the vesical peritoneum.

Complications.—1. *Globular Myoma.*—Globular myoma filling the pelvis is a member of a distinct group which recurs regularly enough to call for a definite plan of treatment. When a tumor just large enough to fill the pelvis arises from the lower part of the body of the womb, the operator is embar-

rassed in his efforts to lift it up and out of the pelvis and through the incision so as to deal with it comfortably, and sometimes the situation is not relieved by grasping the growth with a stout museau forceps and making strong traction. Also, he cannot get room enough in the choked pelvis, between the

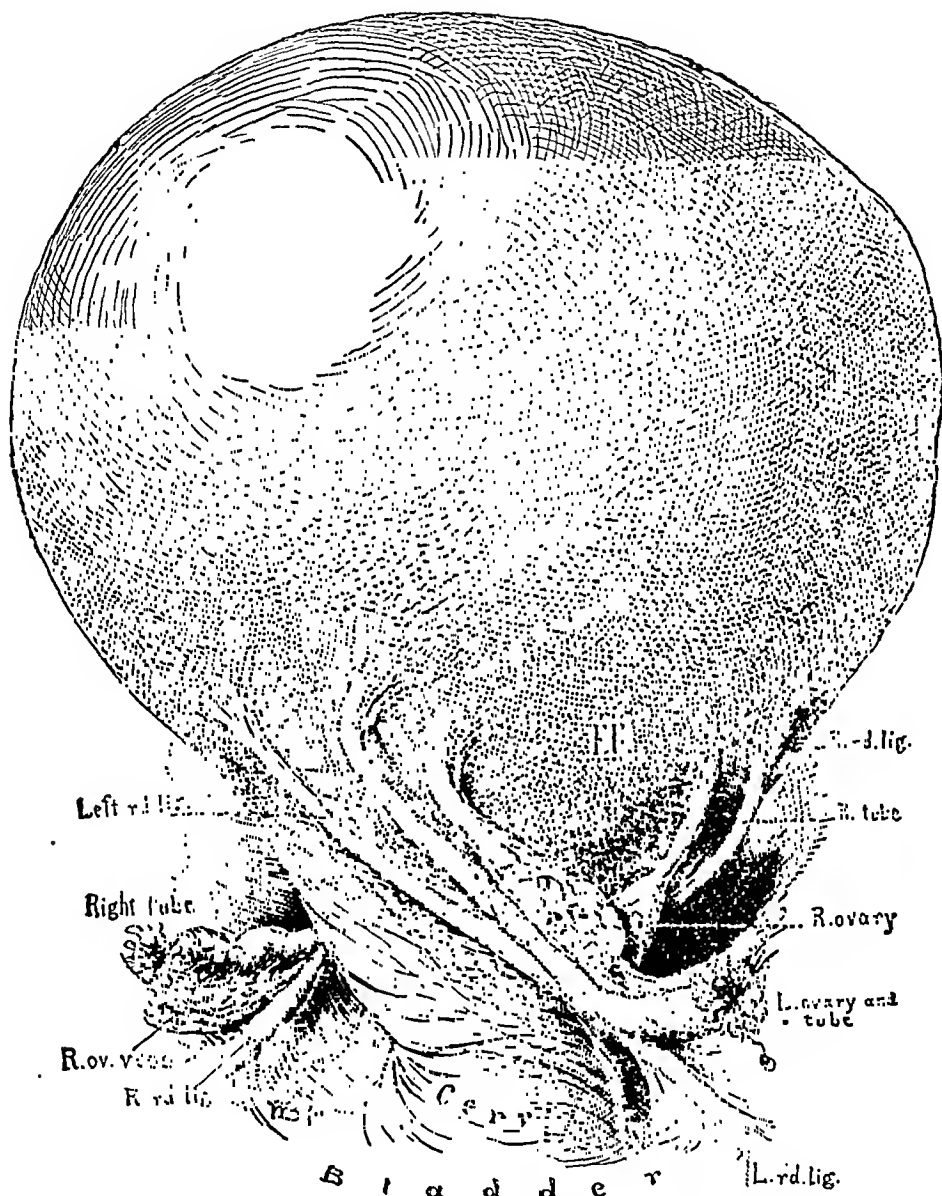


FIG. 430.—TORSION OF GLOBULAR MYOMATOUS UTERUS FROM LEFT TO RIGHT, BRINGING FUNDUS TO FRONT AND RIGHT TUBE AND OVARY AROUND TO LEFT SIDE.

Tumor occupies entire anterior uterine wall. Operation. Recovery. $\times \frac{2}{3}$.

tumor and the pelvic walls, to tie off the broad ligaments and more particularly to reach the uterine arteries. This difficulty is met by catching the top of the uterus with a museau or stout bullet forceps on the left side and rotating the tumor as it lies in the pelvis so as to expose the top of the broad ligament. This is cut through, and by rotating still more the uterine artery is rolled up, exposed, and tied, when the growth can be lifted out of the pelvis, the

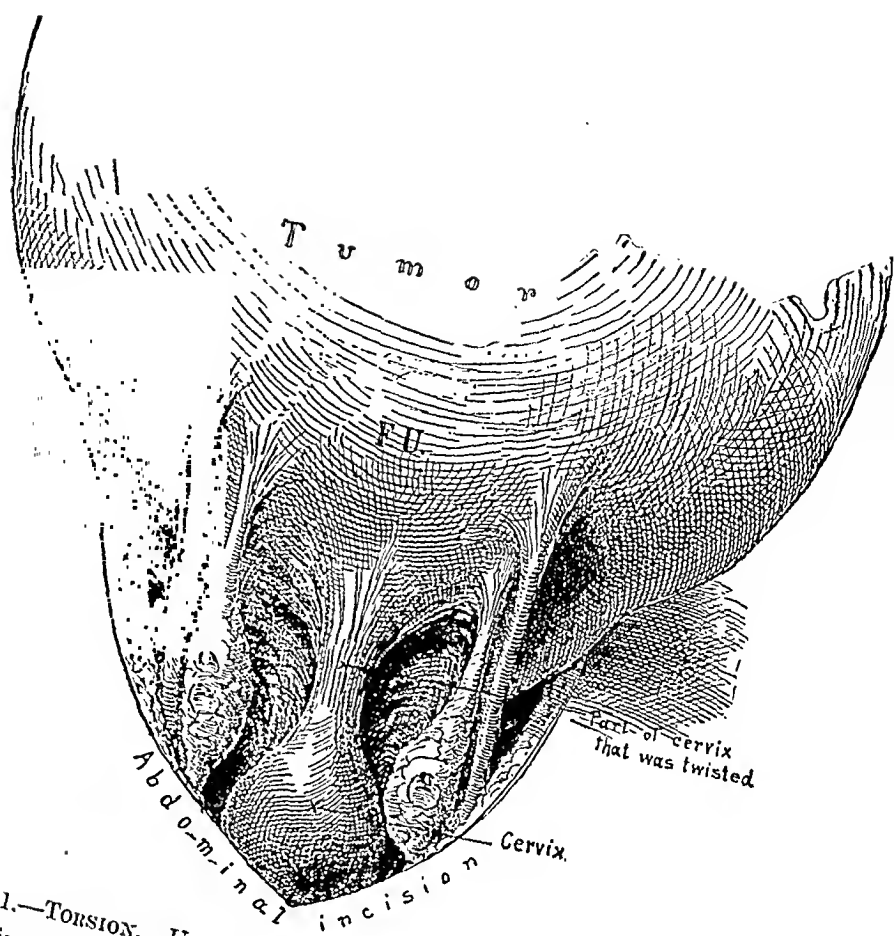


FIG. 431.—TORSION. UTERUS SEEN IN FIGURE 430 UNTWISTED. Note knoblike cervix and thinned-out supravaginal position. As seen from above and from behind.

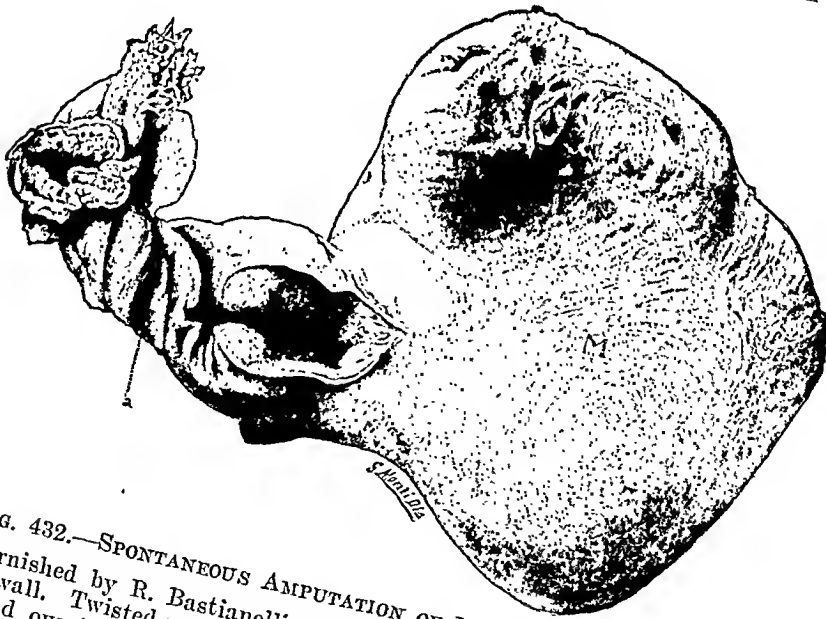


FIG. 432.—SPONTANEOUS AMPUTATION OF MYOMATOUS UTERUS. Illustration furnished by R. Bastianelli to T. S. Cullen. Large myoma on right grown fast to abdominal wall. Twisted pedicle at *a* consists of broad ligament, round ligament, and atrophied tubes and ovaries. Complete separation of uterus from cervix. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders.) $\times \frac{1}{2}$.

cervix cut across, and the operation completed in the usual way. To get a grip on the tumor, cut into it and excise a wedge.

Myomata wedged in the pelvis form a peculiar group of frequent recurrence.

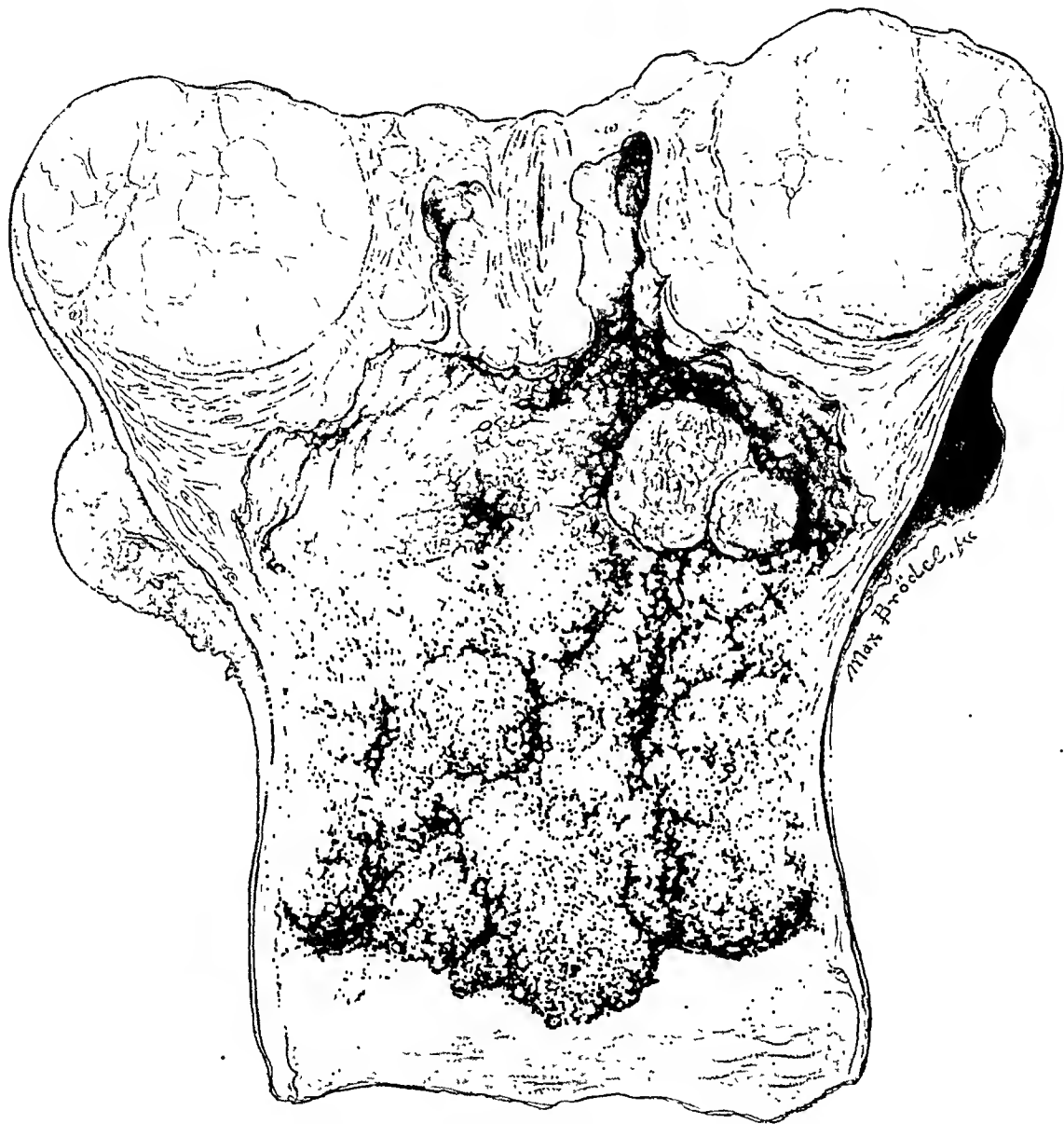


FIG. 433.—MYOMA AND CARCINOMA IN NEGRESS.

Zones occupied by preference by two forms of disease. Fundus converted into mass of myomatous nodules while entire lower segment of uterus is replaced by carcinomatous vegetations. Metastases in inguinal glands are egg-sized. Disease extends through broad ligaments to bladder; metastases also in mesenteric, retroperitoneal, and bronchial glands, as well as in lungs, pleura, and intestinal serosa. Anemia of all organs and a fatty degeneration of liver. Hydro-ureter. Myomata are not involved in carcinomatous process. Death from profuse hemorrhage without operation. $\times \frac{5}{7}$.

On opening the abdomen the pelvis is found choked with tumors, the landmarks are obscured, and the operator upon seeing the immobility of the mass anticipates a prolonged and difficult enucleation. If, however, before beginning the operation he has noted the vaginal cervix in front and the main masses

wedged in the posterior pelvis, he will be able to rectify the chief source of difficulty by instructing an assistant to push strongly upward on the tumor with two fingers in the vagina, while he himself makes strong traction from above with a museau forceps; as the tumor escapes from its bed it gives forth a peculiar loud sucking sound, and the whole mass rotates on its transverse axis as it comes up and out. A case of this sort came to autopsy without

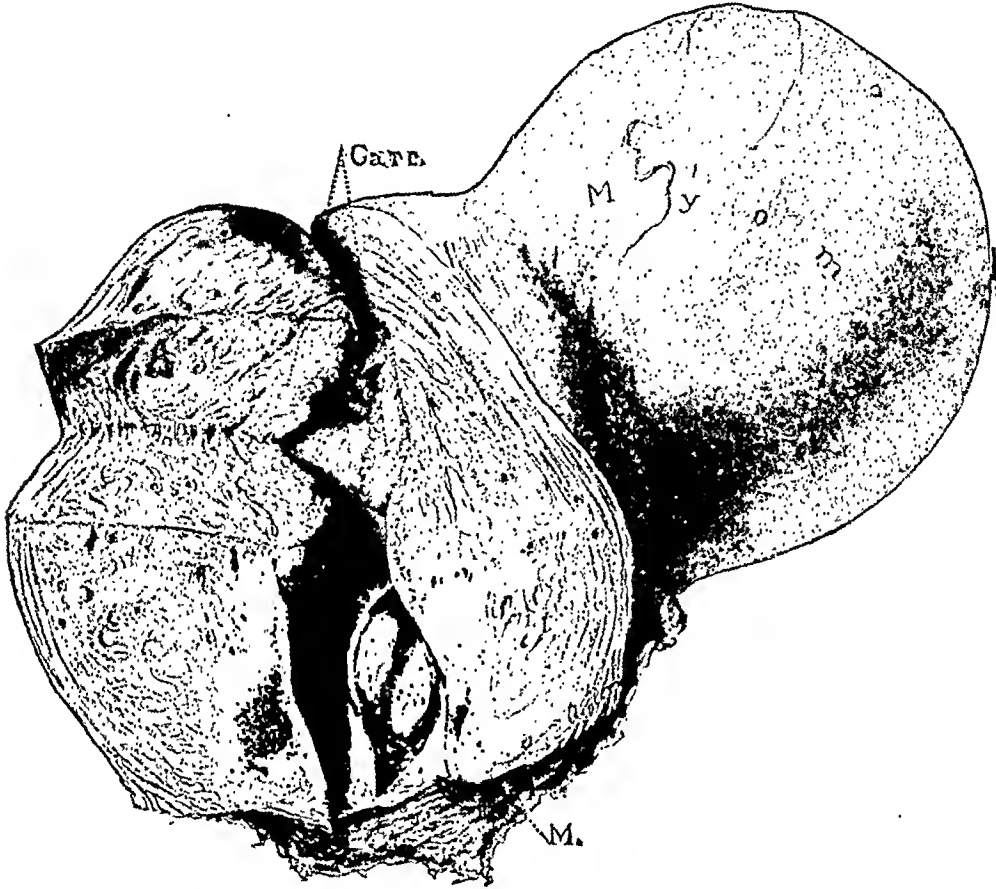


FIG. 434.—ADENOCARCINOMA OF BODY WITH MYOMATA.

Sent by Paul Owsley to T. S. Cullen. Note small myoma near cervix (*M*) and early carcinomatous growth not broken down at fundus. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{1}{2}$.

operation, Figures 408 and 409. The top of the mass, Figure 428, occupied the floor of the pelvis before it was lifted out.

2. *Torsion*.—Myomatous uteri, as one would naturally expect from the broad base of attachment, are rarely found with a twisted pedicle. In any large service, however, cases are seen from time to time. The torsion may effect a pedunculate tumor on the fundus, Figure 429, or the body of the uterus with a large more or less spherical tumor may revolve on a thinned-out cervix, including the broad ligaments as a pedicle, Figures 430 and 431. R. Bastianelli of Rome observed a spontaneous amputation of a myomatous uterus, Figure 432. Lesser degrees of torsion amounting to a quarter of a turn are not infrequent, due to the slight movements of accommodation of the con-

tained body acted upon by the mobile abdominal walls. There is sometimes noted a tendency for the displaced structures to become adherent, fixing them in their new position. The complication at the time of operation is likely to be simply a matter of dealing effectively with the adhesions.



FIG. 435.—LARGE CERVICAL MYOMA WITH ADENOCARCINOMA OF BODY.

Globular myoma behind cervix 7 centimeters. Various subperitoneal and interstitial myomata. Uterine cavity filled with massive carcinomatous growth. (a) Cervical canal. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders.) $\times \frac{1}{2}$.

3. *Adenocarcinoma*.—In fourteen hundred myomatous uteri, adenocarcinoma of the body was found in twenty-five, about 1.7 per cent. Hemorrhage was the one significant feature, but as this is often found with myomata, it is often not distinctive. In some there was a suspicious watery and foul discharge.

The importance of the matter is such that whenever possible hemorrhagic uteri should be curetted for microscopic study; with this precaution mistakes will be rare. A malignant endometrium calls imperatively for panhysterectomy and great care in the removal not to contaminate the peritoneum, Figures 434 and 435. The invasion of the fibrous tumor by the carcinoma is shown in Figure 436.



FIG. 436.—ADENOCARCINOMA INVOLVING MYOMA. SECONDARY TO BODY OF UTERUS.

Excess of connective tissue. Groups of carcinomatous cells scattered abundantly throughout myoma, usually appearing as glands lined with one layer of cuboid epithelium (*a*). In a few places, glands filled as at *b* or large solid masses as at *c*. (*d*) Irregular mass of cells tending to branch. (T. S. Cullen.) $\times 125$.

4. *Cancer*.—Cervical cancer was found in eighteen cases, almost invariably squamous-cell and in varying degrees of advancement. One such is shown in Figure 437. The chief interest here centers in its recognition before operation, whether in an early or a late stage, and in the effect of such a discovery upon the operation. The cervix should in every case be examined carefully and any suspicious area pinched off and studied. In case the lesion is advanced, radium is the best therapy, Figure 438.

In case a recognized cancerous uterus is to be removed, two principles must prevail in the operation. The vagina must be cleaned, even to the extent of curettage and cauterization of a cervical growth, and the vault painted with a 20 per cent mercurchrome solution and packed loosely with gauze tied to a string. The abdominal operation then proceeds to the point of the incision



FIG. 437.—INTERSTITIAL MYOMATA. SQUAMOUS-CELL CARCINOMA OF CERVIX. DOUBLE PYOSALPINX.

Colored woman, 43, nullipara. Cervix occupied by typical carcinomatous growth. Upper nodule nourished by omental adhesion. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{3}{4}$.

of the vaginal vault in the complete enucleation. At this point, if not earlier, the abdominal incision is protected with sedulous care, either by drawing the peritoneum and skin together or by covering it on all sides with rubber protective and gauze to prevent any contamination in the subsequent steps. The vaginal gauze is withdrawn and the uterus removed, keeping separate all instruments used as contaminated. After the insertion of a liberal vaginal

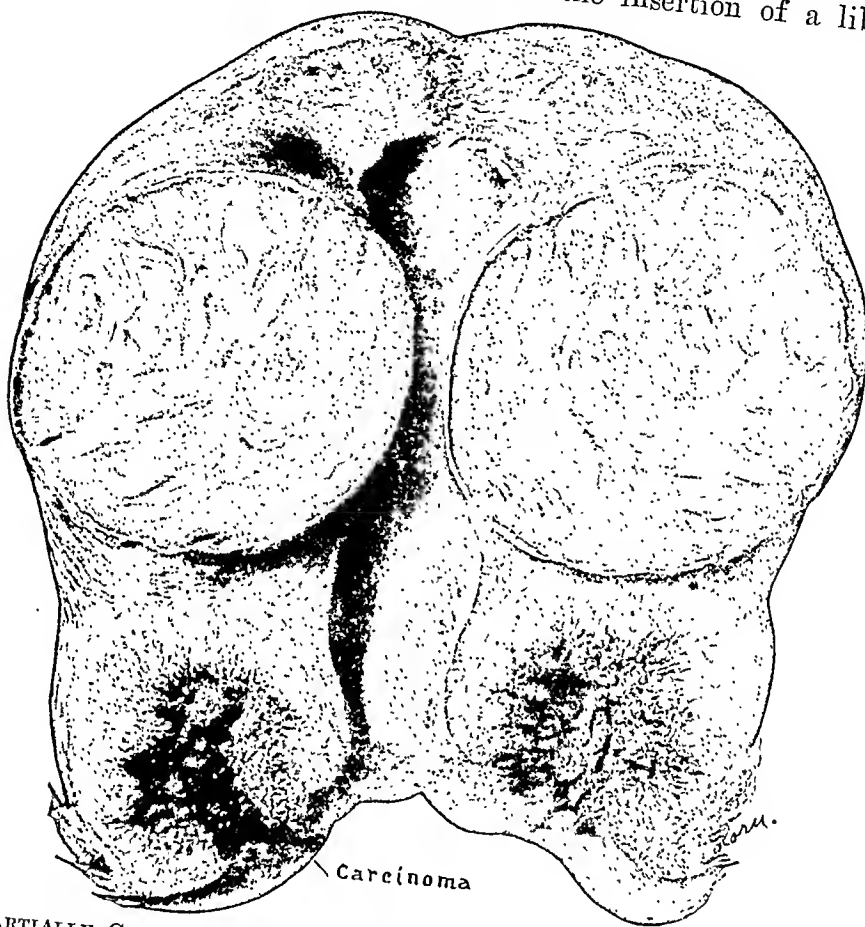


FIG. 438.—PARTIALLY CALCIFIED INTERSTITIAL MYOMA WITH SQUAMOUS-CELL CARCINOMA OF CERVIX.
Calcareous whitish shell invests myoma like capsule. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{1}{2}$.

drain, it is best for the operator to retire and let the assistant close the abdomen. All gloves should be changed.

5. *Angiomyoma*.—The vascularization of the uterus is excessive and totally independent of any interference with the return of the blood delivered by the arterial channels. The occurrence is on an average of one in several hundred. There is nothing in this condition to militate against the success of the operation.

6. *Suppurating Myoma*.—It is surprising that, frequently as necrosis occurs in the poorly nourished interior of large tumors, suppuration is not more common. It is, however, fortunately, one of the rarer sequelæ.

A suppurating myoma in which the tumor forms a shell filled with pus is rare, not including here those sloughing submucous tumors discharging *per vaginam*.

It commonly occurs in three ways:

(a) A simple large myoma which on opening the abdomen feels suspiciously fluctuant but which ought not to be opened until removed.

(b) A tumor which has contracted dense adhesions with all surrounding

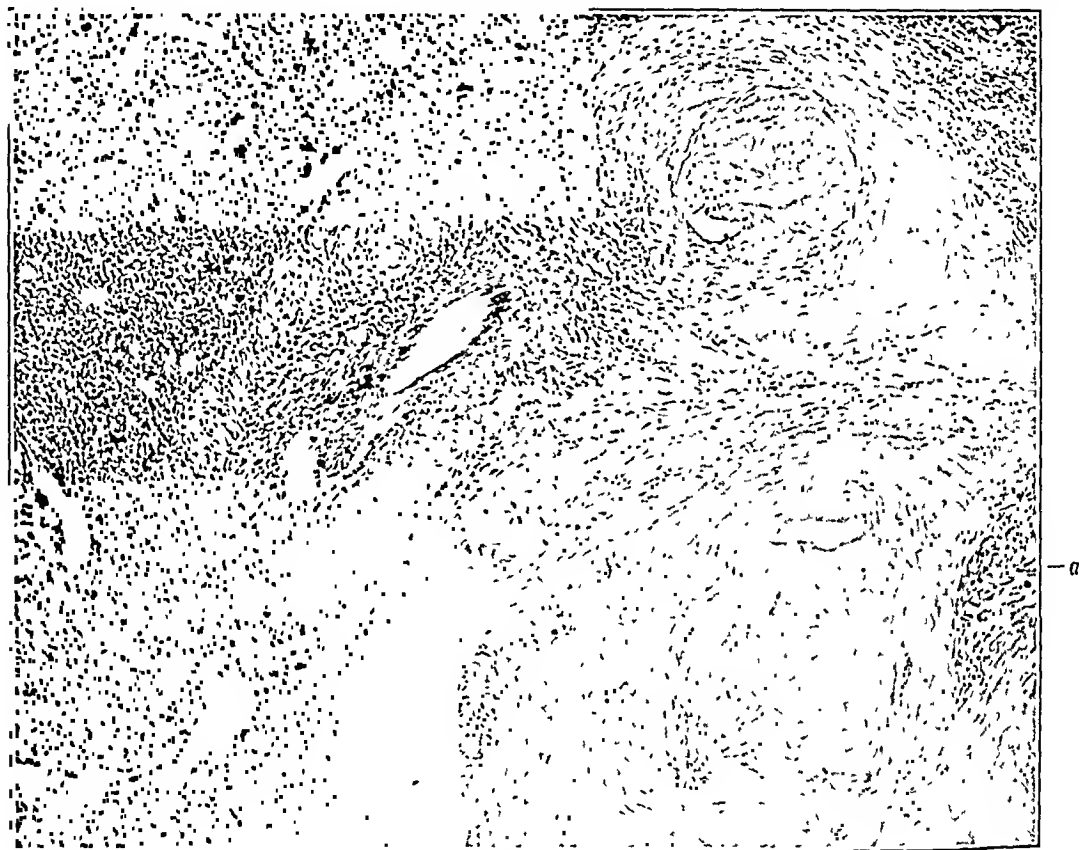


FIG. 439.—MYOMA WITH SARCOMATOUS DEGENERATION.

At the lower right myoma shows hyaline degeneration with a few muscle-fibers as at *a* still unchanged. Above is malignant tumor composed entirely of small round cells with but little stroma. (J. H. U., Gyn.) $\times 180$.

structures—cecum, colon, small intestine, omentum chiefly, and abdominal and pelvic walls—simply calls for the utmost care in the enucleation, tying vessels and here and there leaving little slivers or larger plaques of the myomatous capsule adhering to bowel or pelvic wall and so avoiding serious additional complications. Such was a patient with a large intraligamentary mass on the right, who came to the clinic greatly prostrated with a septicemia, Figure 440. The tumor had dense parietal adhesions and the omentum was attached by its entire free border, together with the cecum, colon, and small intestines on the right. The abdominal incision was 16 centimeters long, the fluctuating myoma tapped, and 4,700 c.c. of pure pus evacuated. The great difficulties on the right were overcome by cutting first down through the left broad ligament,

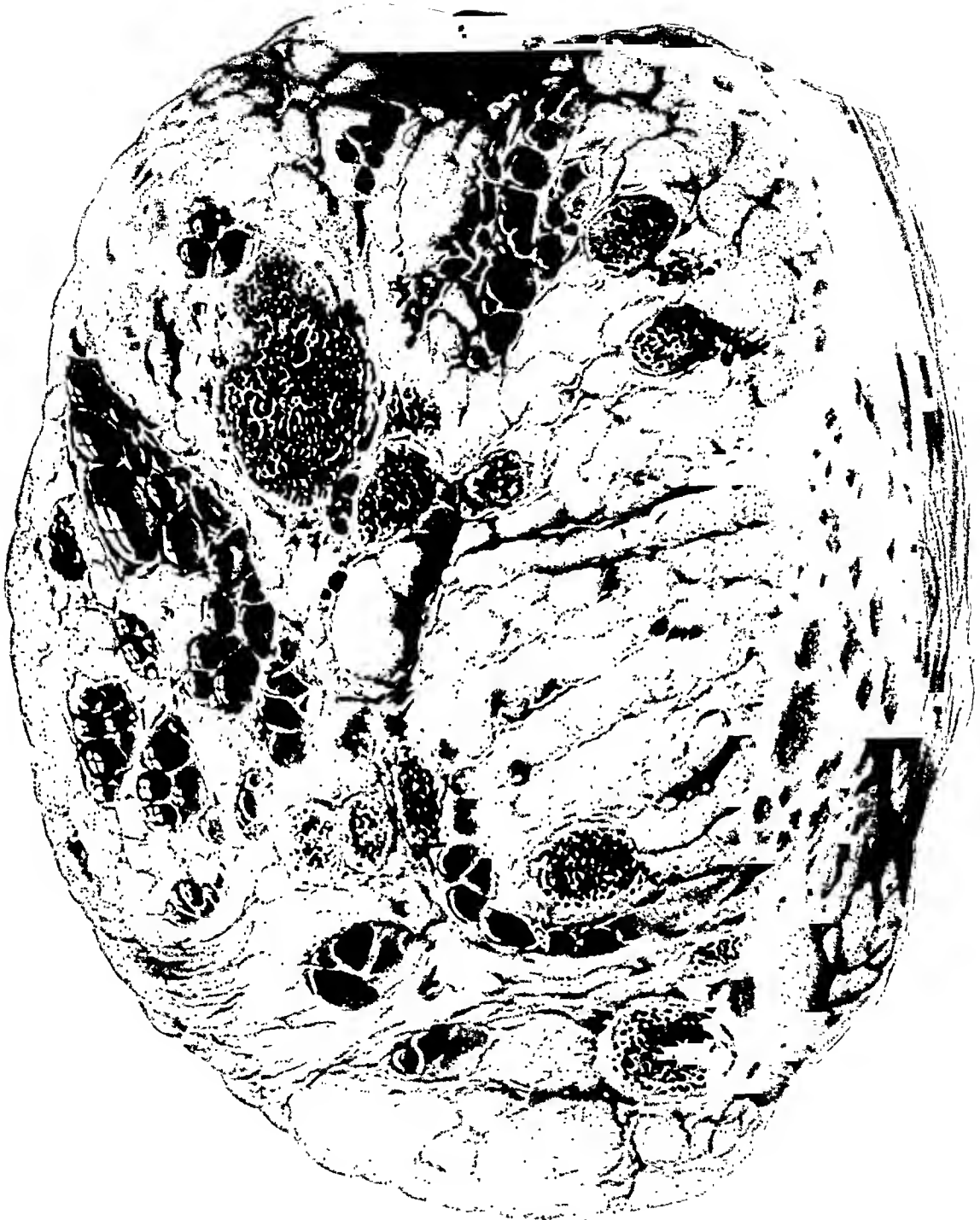


PLATE II.—MULTIPLE ANGIOMYOMATOUS FOCI IN MYOMA.

Section through interstitial myoma, 15 × 20 × 22 centimeters. Scattered throughout tumor, groups of cysts derived from hyaline material. Sharply outlined dark-red and bluish porous areas consist almost entirely of blood-vessels, chiefly arteries. × $\frac{2}{3}$.

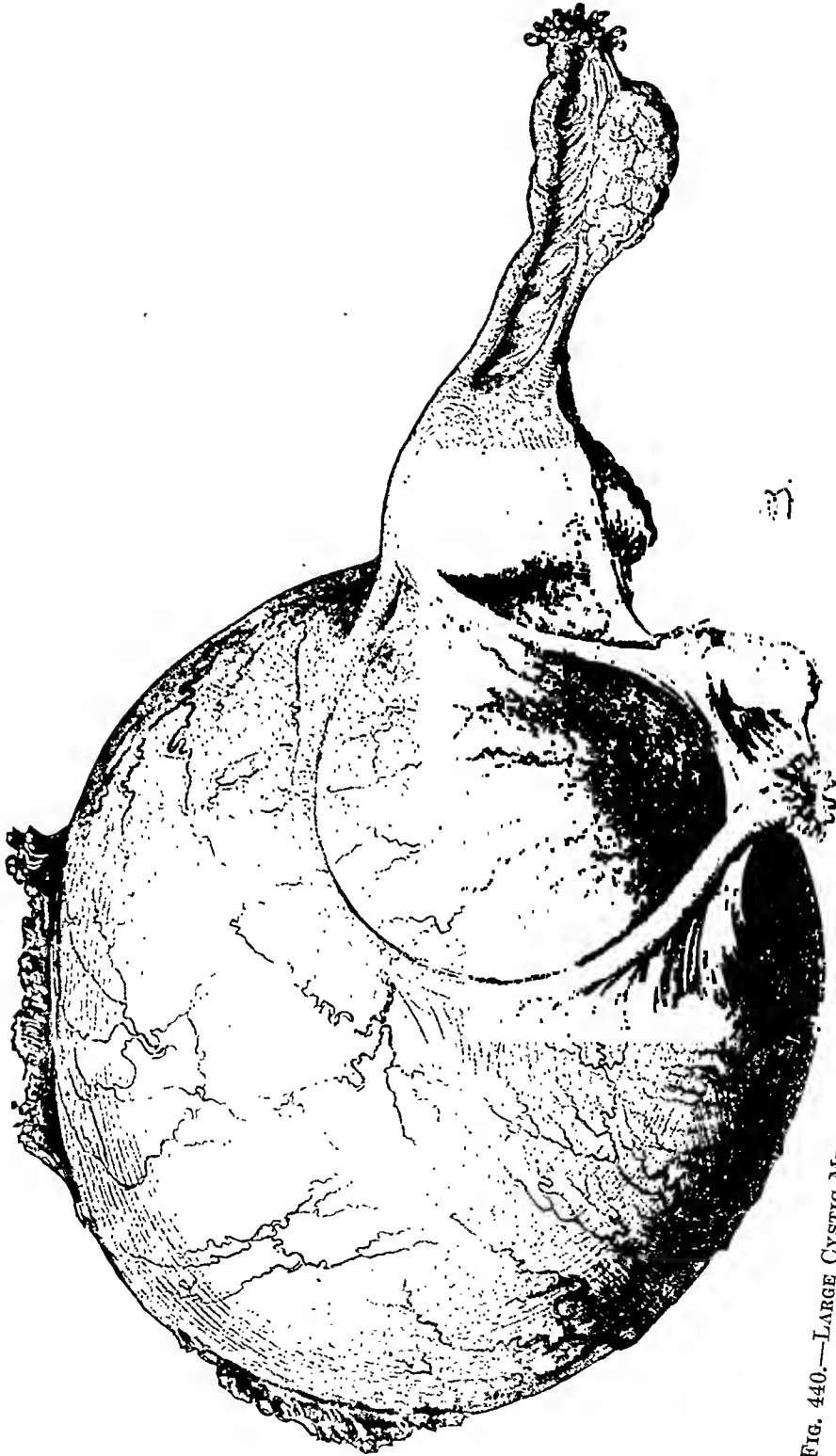


FIG. 440.—LARGE CYSTIC MYOMA OF LEFT BROAD LIGAMENT, FILLED WITH PUS; REMOVED BY HYSTEROSALPINGO-OÖPHORECTOMY. Uterus, right tube, and ovary intact. Left tube and utero-ovarian ligament greatly lengthened and spread out on posterior surface of tumor; mesosalpinx obliterated. Surface of tumor deeply injected and covered with large vessels. Above and left on periphery of tumor are extensive omental adhesions. Operation. Recovery. $\times \frac{1}{2}$.

ligating the uterine, and amputating the uterus in the cervix, and then ligating the right uterine artery. As the uterus and the big collapsed tumor were rolled up and out, the adherent intestines were accessible from below and easily

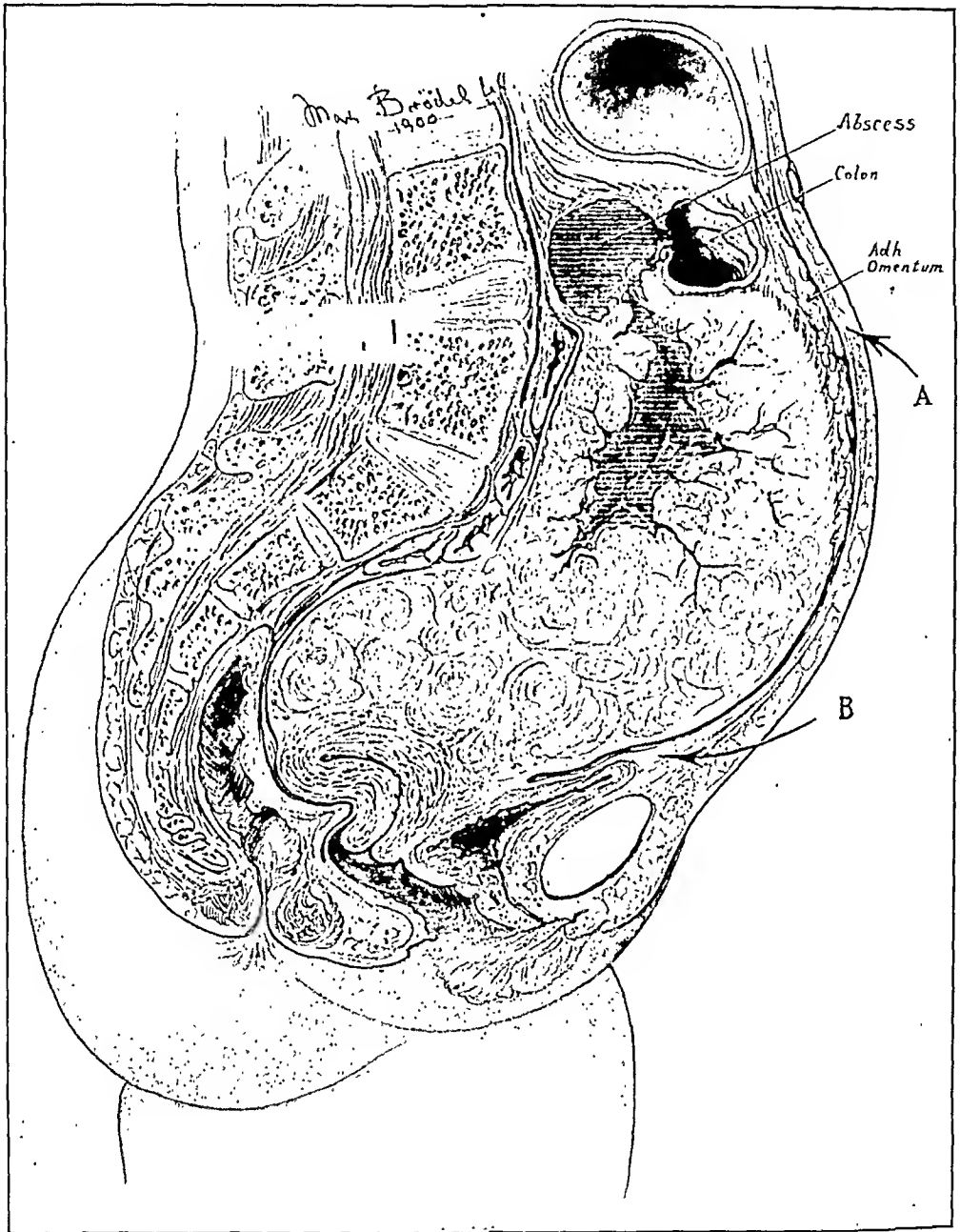


FIG. 441.—SAGITTAL SECTION OF LARGE NECROTIC MYOMA COMMUNICATING BY ABSCESS CAVITY WITH TRANSVERSE COLON.

Arrow *A* shows direction of enucleation first attempted and found impossible. Arrow *B* shows direction next taken and followed successfully.

separated, the omentum tied off, and dense abdominal-wall adhesions treated by leaving attached a plaque of the superficies of the myoma dissected from its capsule. Tapping seemed necessary here to expose the adherent bowels beneath. She recovered and was in good health a year later.

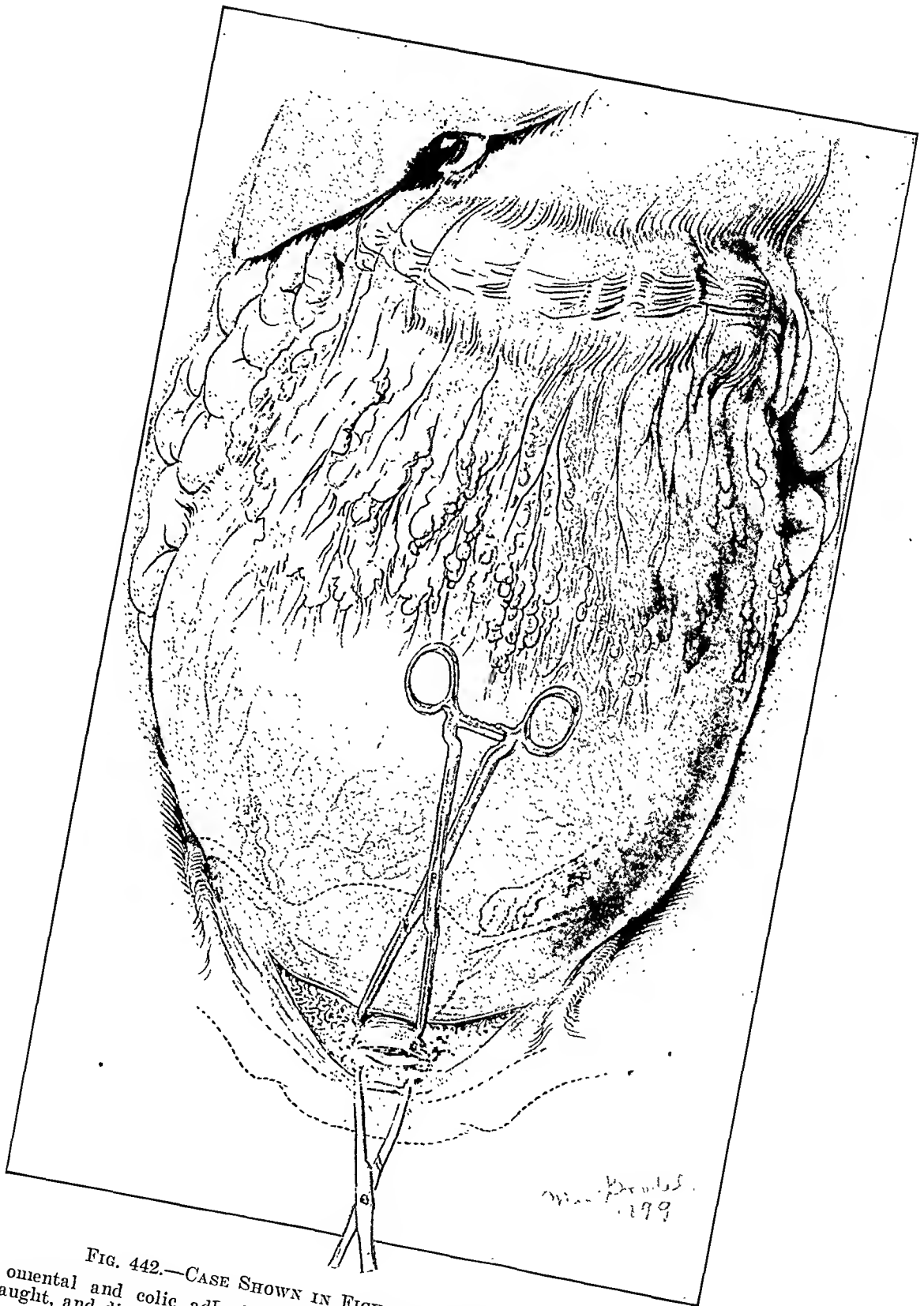


FIG. 442.—CASE SHOWN IN FIGURE 441, ANTERIOR VIEW.
Dense omental and colic adhesions above, barred progress in that direction. Cervix
exposed, caught, and divided as shown. (See Fig. 443.)

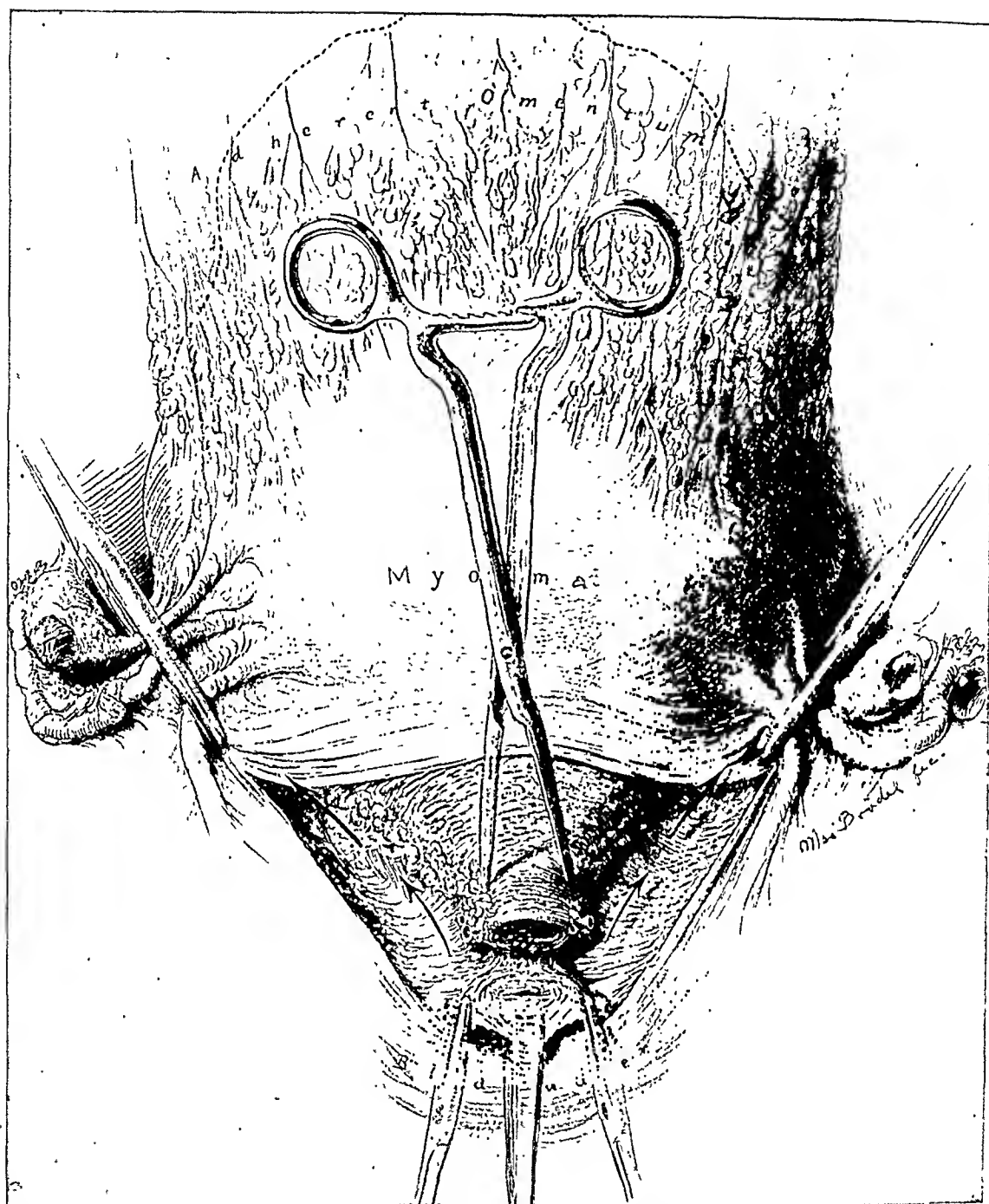


FIG. 443.—ON DIVIDING CERVIX AND DRAWING ITS SURFACES APART, UTERINE VESSELS WERE EXPOSED, CAUGHT, AND UTERUS COMPLETELY DETACHED FROM ITS PELVIC CONNECTION BY AN ENUCLEATION PROCEEDING IN DIRECTIONS INDICATED BY ARROWS.

Lifting up whole mass, abdomen was easily reached and enucleation completed in direction from behind forward.

(c) A tumor which discharges into some viscus, bowel, or bladder. A complicated suppurating myoma discharging by a fistulous orifice into the transverse colon always offers a difficult problem, Figure 441. In an instance seen in our clinic, the entire center of a large mass filling the lower abdomen was necrotic with a vast abscess cavity discharging into the colon (*Johns Hopkins*

Hosp. Bull., 1900, 3: 56). An added serious complication was extreme weakness and a pulse of 140 at the onset of the operation. The abdominal incision was made and it was found impossible to make any headway whatever by detaching omentum and colon from the anterior face of the mass. The size of the tumor and its dense adhesions completely locked it *in situ*. The following plan was then adopted with success: The cervix, which could be felt *per vaginam*, was exposed by detaching the vesical peritoneum and caught with



FIG. 444.—SUPPURATING SUBPERITONEAL MYOMA OPENING INTO CECUM.

Uterus enlarged by myoma in left broad ligament and at fundus on right a pedunculate myoma 7 X 5 centimeters, largely nourished by omentum. Center contains an abscess opening into cecum at *a* where fistulous tract has been severed. Note also adherent appendix. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.)

two bullet forceps, one above the other, Figure 442. The uterus was then divided horizontally in its cervical portion by plunging a knife through the cervix anteroposteriorly, with the utmost care not to touch the lateral vessels. The divided cervical surfaces were next pulled apart, Figure 443, the uterine vessels exposed and controlled, and the uterus liberated by continuing the enucleation in the direction from below upward; this broke the lock and the tumor remained adherent only by its densely adherent upper pole. Proceeding with the enucleation, the enormous abscess in the tumor ruptured, and with the collapse thus effected it was possible to roll the tumor out and to enucleate it in a direction from behind forward without any further injury to the bowel than was necessary in exposing the fistulous opening into the

transverse colon. The enucleation completed, the bowel opening was sutured and the abdomen closed with a liberal drain. She made an excellent recovery.

7. *Tuberculosis of the Endometrium.*—Tuberculosis of the endometrium occasionally complicates the myomatous condition. Out of 934 uterine tubes examined (Kelly-Cullen, *Myomata of the Uterus*, p. 335), in seven there was a bilateral tuberculosis only recognizable in six upon microscopic examination. As a rule there is no demonstrable connection between the myoma and the invading bacillus. In six the uterus was relatively small; in one it reached the size noted in Figure 445.

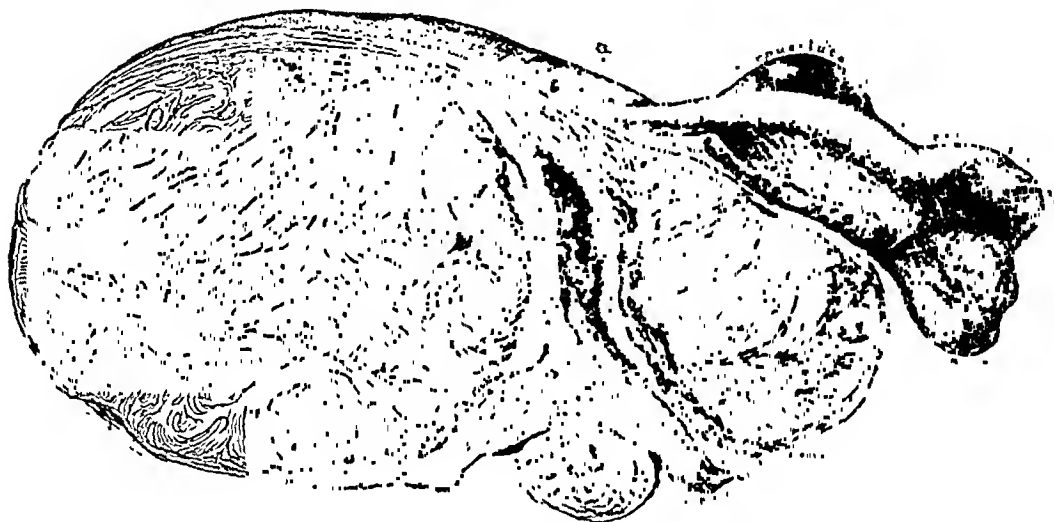


FIG. 445.—TUBERCULOSIS OF ENDOMETRIUM IN MYOMATOUS UTERUS.

Measures $15 \times 17 \times 20$ centimeters. Endometrium at *a* tuberculous. Left tube thickened and tuberculous. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{1}{2}$.

A specimen sent by Homer Gage to T. S. Cullen showed an implication of an interstitial myoma, diameter 7 centimeters, riddled with caseation, surrounding islands of uterine mucosa (adenomyoma); both tubes were tuberculous.

8. *Ascites.*—Ascites is a complication not rare if we include lesser as well as larger quantities of serum. One seldom, however, finds as much as 1 or 2 liters of serum. The cause is not known. One of the most striking cases I have seen carried 7 liters of fluid. She was thirty-two years old. Soon after the birth of the youngest child, five years old, she noticed a lump in the lower abdomen, which remained stationary in size for over three years when, without apparent cause, the abdomen enlarged. On admission to the hospital, the large abdomen was uniform and fluctuating. The umbilical circumference was 87.5 centimeters, Figure 404.

9. *Pregnancy.*—(a) *Intra-uterine.*—The question of pregnancy and myoma has been dealt with particularly by Kelly and Cullen (*Myomata of the Uterus*, 1909), C. Lockyer (*Fibroids and Allied Tumors*, 1918), and E. Scipiades (*Zentralbl. f. Gynäk.*, 1913, 37).

The presence of a myoma distinctly hinders the nidulation of the ovum *in utero* by reason of the rigidity of the uterine wall and its distortion, as well as the pressure interference with tubal function plus the often increased congestion and hemorrhages, making the percentage liability six times less than the general average (E. Scipiades). Pregnancy does, however, occur, and at times under extraordinary conditions. It sometimes happens in a woman up in her thirties, who has had a secondary sterility for some years, or, again, after several children and a childless interval. The greatest liability to conception is when the tumor is less than apple-size, subserous, and well away from the mucosa. In one who is evidently distressed by her tumors, the liability is 0.01 per cent.

T. B. Phillips (*vide* C. Lockyer, *Fibroids and Allied Tumors*, p. 166) found in 814 married women that 29.9 per cent were sterile; the 550 fertile had had 1,805 children and 441 abortions, a goodly average.

The diagnosis of pregnancy may be easy or difficult. It is easy when the woman, aware of her myoma for some years, notes a cessation of the menses with the rational signs of pregnancy, including abdominal enlargement. The examination reveals a uterus with a well-defined myoma and with a suspiciously softened area; later, fetal heart sounds, bruit, breast palpitation, and movements become distinctive.

If the pregnancy is early and there is doubt, one can usually well afford to await further developments.

Again, the first evidence of pregnancy may be upon the operating table, or even in the pathological laboratory.

Intimately related to the various questions arising in so seriously complicated a situation is that of the advisability of myomectomy in a woman who is sterile and desirous of offspring, in the hope of curing her sterility. Of ninety-four subjected to myomectomy, mostly interstitial, thirteen became pregnant and twelve went to term.

In the event of pregnancy, the question becomes that of determining whether the tumor is likely to interfere with delivery *per vias naturales*, often best determined by examining in anesthesia. Generally speaking, tumors lying in the upper part of the uterus and pedunculate growths admit of sufficient displacement to permit a fairly normal labor. The case is also favorable when the tumor can be displaced up above the superior strait. It is otherwise with a large growth fixed low down. Abortions are common from the third to the fifth month, especially when the tumors are numerous.

Speaking broadly, most pregnant women with fibroid tumors go to term and are delivered satisfactorily though labor is likely to be protracted. Too many are interfered with simply because a pregnancy is found in a uterus harboring a fibroid growth; the presence of a myoma *per se* does not justify operation. The danger, if any, lies in the difficult labor at the end and in post-partum hemorrhage.

Subserous tumors rarely cause premature labor; those burrowing under the cellular tissues and the submucous growths are strikingly different in their relations to conception, pregnancy, labor, and puerperium. Of all forms, the submucous is most prone to hinder impregnation as well as to favor abortion; it is also more liable to infection by reason of its exposed position.

If the symptoms of pressure become urgent during any part of the pregnancy, an operation should be done at once, usually hysterectomy. Following a lamentable era of radicalism, a healthful, watchful conservatism has at last set in, the physician taking a stand of armed neutrality, ready to act early and aggressively when symptoms demand it. Abortions must not be done without painstaking consideration of the possibility of the pregnancy going to term successfully. Myomectomy early in pregnancy is usually successful. I cite here a list from Troell (C. Lockyer, *Fibroids and Allied Tumors*, p. 148) of 157 myomectomies in which the fetal mortality was 23.9 per cent. The maternal mortality was 3.9 per cent, and the liability to abortion 14.6 per cent in the first and 30 per cent in the second half of pregnancy. In the delivery of forty-eight at term, 14.5 per cent of the children died or 85.5 per cent of the women who did not abort had a living child. When the tumor was pedunculate, 90.9 per cent went to term, and out of forty-four there were but four abortions. A patient of Lockyer, threatened with abortion, had two tumors of size removed, situated so low posteriorly that the uterine had to be eventrated to reach the lower larger one. There was no dragging on the growths in the blunt and fairly dry enucleation by finger and scalpel handle. The fact that it often becomes necessary for the surgeon who undertakes a myomectomy to finish by extirpation, either for hemorrhage or because of the opening of the uterine cavity (in 12 out of Troell's 157) is an added argument for noninterference unless obviously imperative and makes manifest the advisability of laying the pros and cons clearly before intelligent patients in advance.

Myoma-complicated pregnancies need hospital care, where facilities are immediately available.

When labor supervenes, a forcible forceps delivery, dragging the fetus over the obstruction, is exceedingly hazardous both to mother and child, as is version also. In labor, one must be careful in attempting to push the tumor into the false pelvis as adhesions may be torn or a necrosis infection set free. Colpotomy for the removal of the tumor should not be done.

The operation of election, when the obstruction in the lower pelvis is insuperable, is cesarean section not too long postponed, done for the delivery of the living child and followed by the removal of the entire uterus not including the tubes and the ovaries. A dead child should be removed intact.

To sum up with Scipiades (*ut supra*), the effect of a myoma on the birth varies with its size and location. The dilatation period is usually greatly

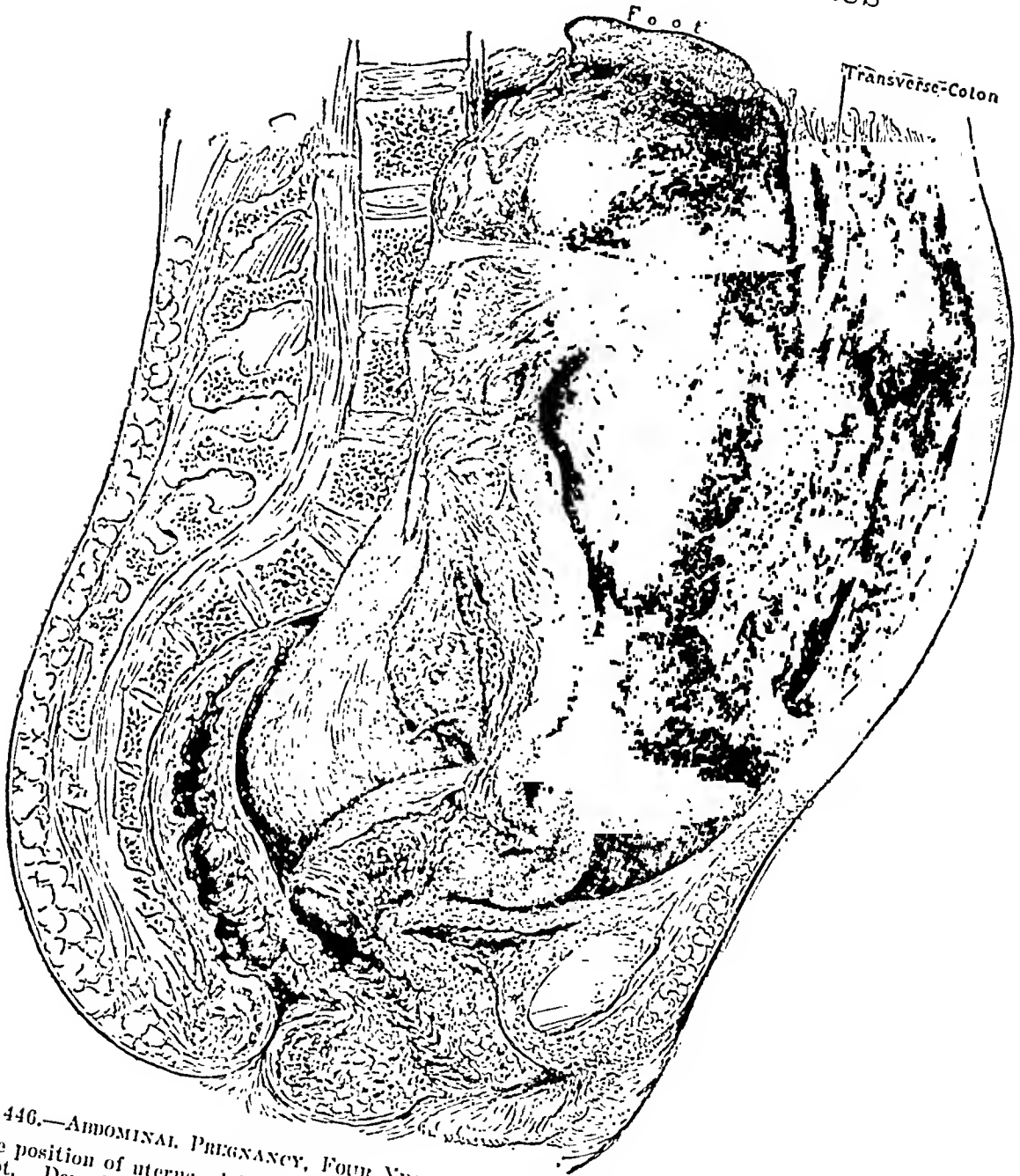


FIG. 446.—ABDOMINAL PREGNANCY, FOUR YEARS' DURATION, RESEMBLING LARGE MYOMA.
 Note position of uterus, right pus-tube, and window cut above its extremity showing hand and foot. Densely adherent omentum and transverse colon. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.)

lengthened; in the expulsion, serious complications may arise due to irregular position, presentation of extremities, and prolapse of the cord, difficulties increasing even to the point of utter impossibility of birth *per vias naturales*. Hindrances are often overcome by the softening and flattening out of the tumor or by reason of its ascent caused by the contractions. The puerperal state is characterized at times by a shrinkage of the growth or even its disappearance.

It is at times complicated by the necrosis and infection of the tumor. Intra-mural tumors may become submucous. Involution is slower and infection more likely.

(b) *Extra-uterine*.—A fibroid tumor acts as a distinct provocative of an extra-uterine pregnancy by reason of the greatly lengthened tube, delaying the progress of the ovum to the uterus, or of the compression of the tube, or of a salpingitis (Loekyer). The discovery of such a complication is of the first importance as it demands relief at the earliest moment. There is often the history of cessation of menses, pains, irregular bleeding, tenderness, nausea, and anemia. Again, the diagnosis is difficult and the condition unsuspected even with a careful history. In 934 myomata (Kelly-Cullen, *Myomata of the Uterus*), six were extra-uterine, five of which were ruptured; five had never had a child at term.

Symptomatically one or the other may predominate, either the myoma overshadowing the extra-uterine or the acute onset of the latter bringing the myoma to light as a complication.

In four of the six cited, the myoma symptoms masked the pregnancy; in one the hard ball-like gestation sac was unruptured. Combined extra- and intra-uterine pregnancy also occurs.

Cullen operated on a secondary abdominal pregnancy of four years' duration, mistaken for a large adherent myoma, Figure 446, too little attention having been paid to a history of a missed labor some years previously. Excessive bleeding; vaginal drainage; recovery.

J. W. Bovee operated upon a negress twenty-five years old (*Am. J. Obst.*, 1914, 49), with a threatened abortion, who, after many months of amenorrhea, had a combined extra- and intra-uterine gestation. A tumor was felt, but as the bleeding ceased, she was discharged and a month later expelled a fetus 30 centimeters long and the placenta. From then on she complained of pain; five months later, cramplike, with a violent hemorrhage. Laparotomy for a hard knotty tumor revealed a mummified fetus 32 centimeters long and its placenta in a membrane, free in the peritoneal cavity. This was overlaid by a myomatous uterus and was generally adherent. The entire mass—uterus and all—was removed.

Loekyer reports an old case with a figure of a pregnancy in one horn of a bicornuate uterus and with a myoma of size in the opposite horn dating back to 1856.

The general rule should be the removal of the uterus, except in a uterus with a single myoma lying under the tube, which offers a good chance of complete restoration and a subsequent normal pregnancy.

10. *Environmental*.—Environmental complications are those involving bladder and ureters, adhesions of the adnexa and various pelvic and abdominal organs, and tubal and ovarian tumors—hydrosalpinx, pyosalpinx, ovarian cystoma, dermoid cyst, malignant tumor of the ovary, papilloma.

(a) **Bladder and Ureters.**—Serious difficulties arise from the pressure of an enlarging myoma on the bladder or from a more or less extreme displacement of the bladder by the growth.

When the tumor starts in the lower anterior part of the uterine body or is subperitoneal or becomes incarcerated in the pelvis, the forward pressure against the symphysis interferes with micturition and ultimately even cuts off the circulation at the neck of the bladder causing necrosis and exfoliation of the entire mucosa. The clinical symptoms are frequent urination (pollakuria), retention of urine, an ever-distended bladder with only occasional evacuations, often coupled with leakage, and in the extreme case foul necrotic mucosa gritty with urinary salts felt with the sound.

Rarely, when the pelvis is choked, the vesical displacement is down and out at the introitus. Cystitis is not a common myoma syndrome.

A serious interference with the bladder function constitutes the *indicatio vitalis* for prompt operative relief.

The displacement of the bladder up in the direction of the umbilicus is due either to the dragging of the tumor as it ascends or to inflammatory bands fixing it to the tumor as it is simply squeezed up, unable to expand in any other direction. The importance of such high displacements is largely operative as it is exposed to injury in opening the abdomen as well as liable to be torn or cut in the hysteromyomectomy, especially when it is thinned out and not recognizable. I once mutilated the bladder, amputating a large piece adherent to the face of the tumor. In case of doubt always pass a sound and determine its upper limit. Also, in making the initial inci-

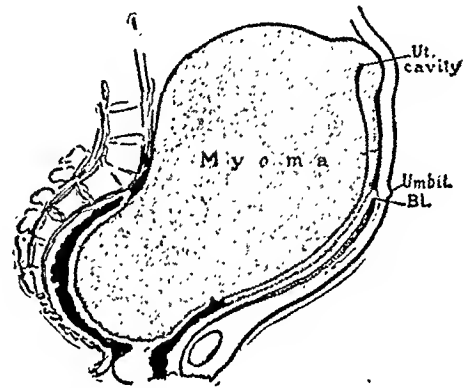


FIG. 447.—BLADDER CARRIED HIGH AS UMBILICUS BY LARGE MYOMATOUS UTERUS.

Fundus forming characteristic slight prominence above. Posterior wall involved in growth. Bladder at umbilicus, with peritoneal reflection. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.)

It is not difficult to release the bladder from its adhesions by passing a blunt curved artery forceps under them, lifting the forceps and then cutting. Where the vessels are large, Figure 449, the problem is more difficult. The better plan here is to free the uterus laterally on both sides, cut cautiously across the line of the mobile peritoneum just above the congeries of wormlike vessels, and then proceed as usual.

Bisection is of the utmost value in single large myomata deep in the pelvis, often cervical in origin. The extirpation in this way collapses one big cavity and renders all parts easily accessible.

Calculus on the bladder is a rare accidental condition. C. Lockyer describes graphically a case of double ureteral calculi, also very rare.

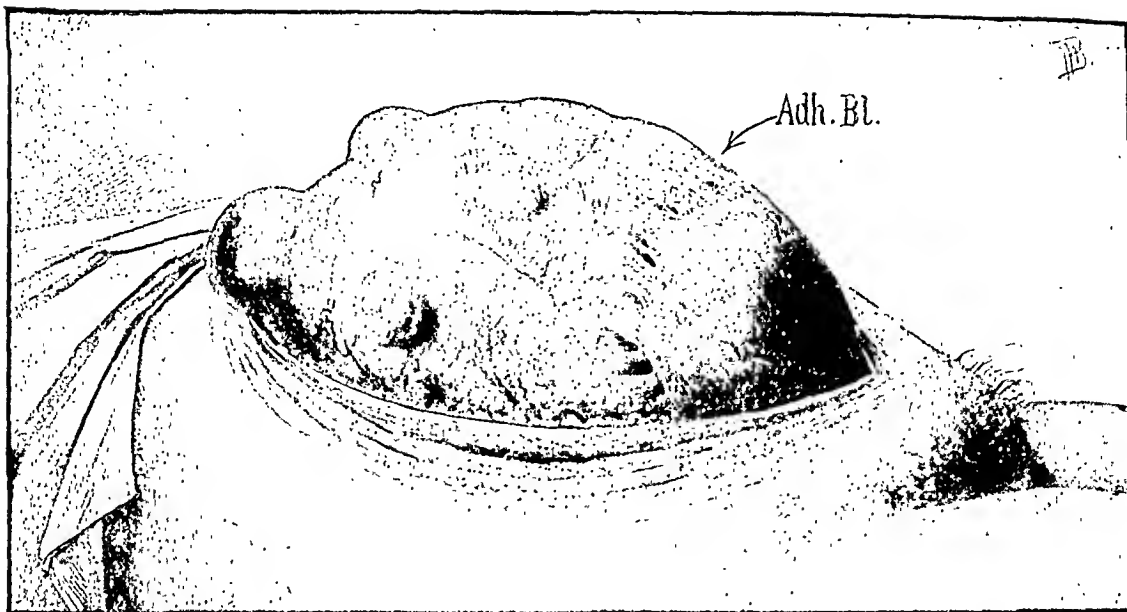


FIG. 448.—LARGE MYOMATOUS UTERUS FILLING LOWER TWO-THIRDS OF ABDOMEN.

Bladder adherent to uterus lifted up out of pelvis and elevated by adventitious peritoneal adhesions. Hysteromyomectomy. Recovery.

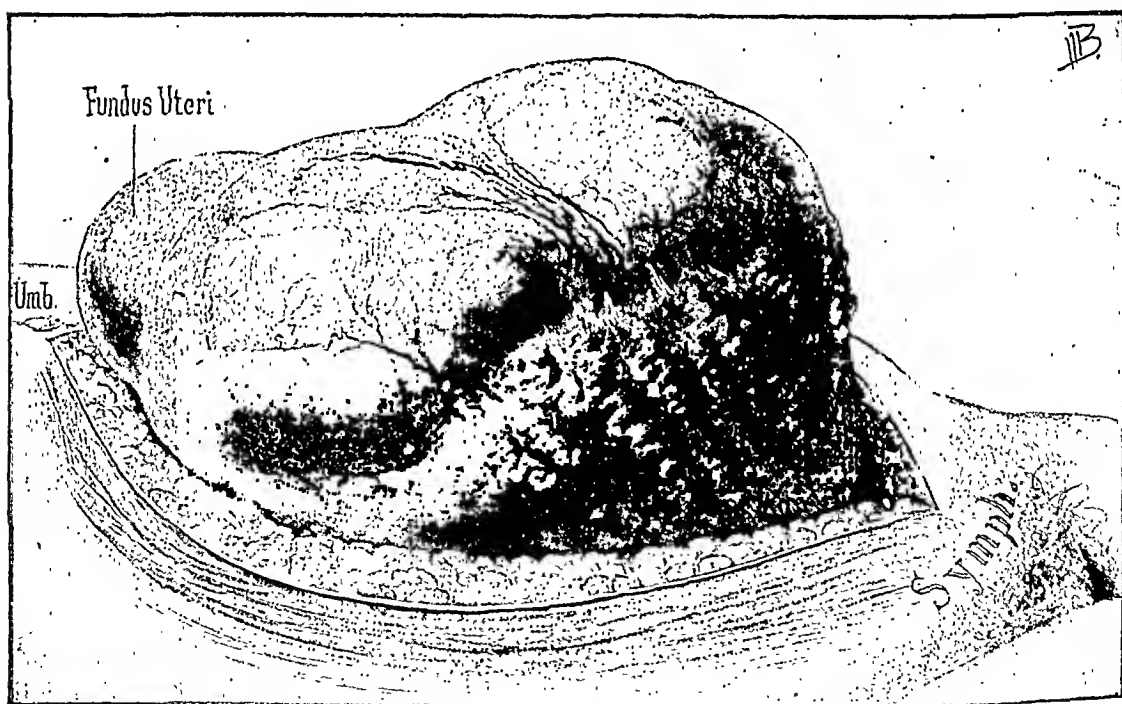


FIG. 449.—DISPLACEMENT OF THE BLADDER BY MYOMATOUS UTERUS WITH FUNDUS AT UMBILICUS.

Position of bladder indicated by enormous tortuous parallel vessels which end at reflection of vesico-uterine peritoneum. Hysteromyomectomy. Recovery. $\times \frac{1}{2}$.

BENIGN TUMORS OF THE UTERUS

Sew a cut bladder up snugly with two or three layers of fine chromic gut and drain it for a few days by the urethra.

The various ureteral injuries are ligation, transfixation with needle and ligature making a lateral opening, a cut into the lumen with the scalpel, complete division, the sacrifice of a substantial piece adhering to the tumor, as well as the deliberate excision of a section in a wide extirpation for cancer.

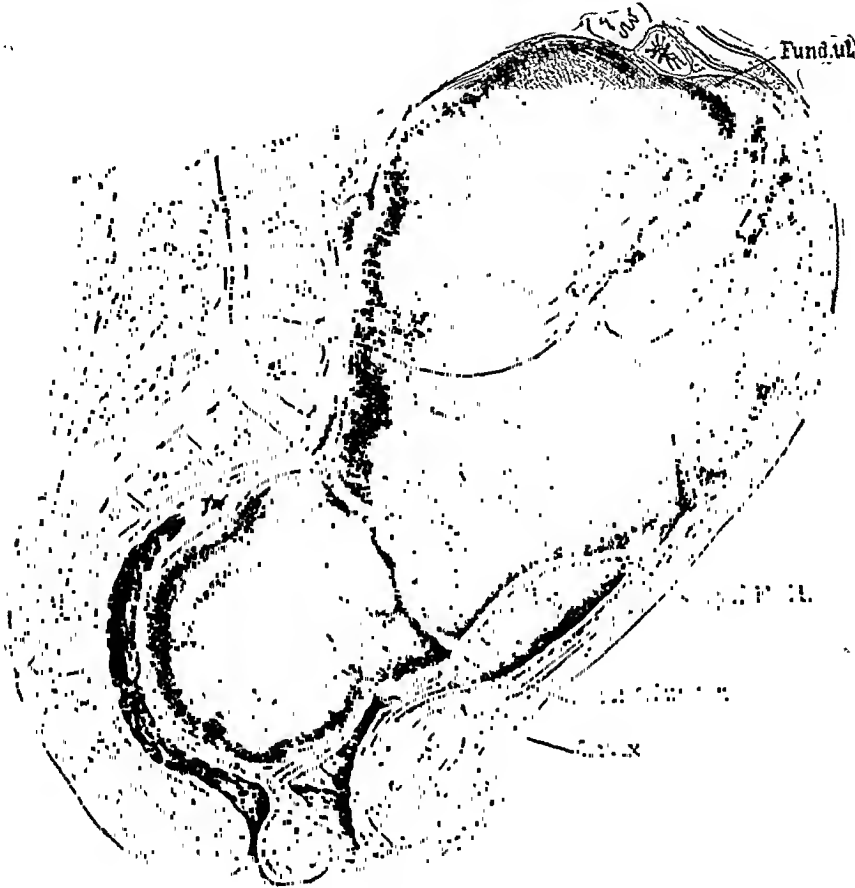


FIG. 450.—COMPLICATED HYSTEROMYOMECTOMY.

Pelvic peritoneum displaced high up into abdomen by enormous myomatous uterus, indicated by line beginning above bladder and extending up to round ligament, oviduct, and ending above sacral promontory. Fundus above and on top of uterus; sigmoid flexure above umbilicus seen in cross section. Bladder lies wholly in abdomen, and both ureters are displaced above pelvic brim; left is indicated in dotted outline. Pelvis also choked by tumor; cervix near level of superior strait behind symphysis. Hysteromyomectomy. Recovery.

As the bladder ascends into the abdomen, the ureter often follows, especially if the tumor burrows under the peritoneum, not alone displacing but often compressing it and causing a dilatation (hydro-ureter). Especially in all unusual tumors must the operator keep the ureters in mind, proceeding slowly and with extreme caution until both are identified and their course obvious from pelvic brim to bladder. A good place to find the ureter is to pinch it up with the bunch of ovarian vessels about the pelvic brim; this is easily done by touch alone. Once identified at this point its trajectory is

traceable to its terminus, Figure 450. The vermicular movements of the ureter are also characteristic. When the tubes and the ovaries are found displaced high up, the ureter is often not far away.

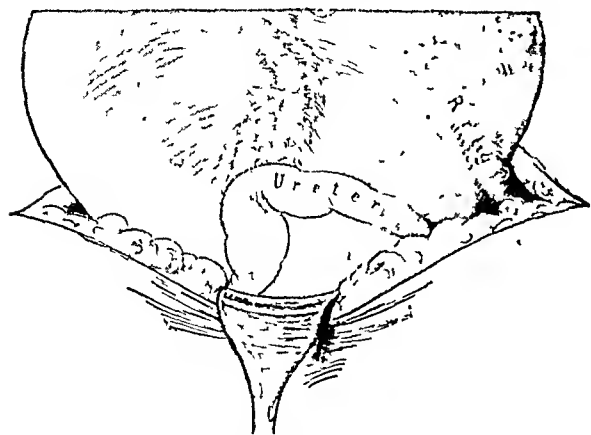


FIG. 451.—DISLOCATION OF RIGHT URETER FORMING ANGLE ON SIDE OF MYOMATOUS UTERUS.

Displaced ureter brought out of abdomen with uterus, easily mistaken for dilated lymphatic vessel. Congeries of vessels above ureteral angle are the ovarian. Both lifted high up in abdomen. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.)

sight with the flaccid capsule and escapes injury.

When a ureter is tied, it is usually sufficient to cut the knot and release it.

A nick in the side is closed by a fine suture; also, a transverse division of the ureter can be closed by circular sutures; an oblique cut gives a better lumen as Bovee has shown.

If there is any doubt as to the technique of the closure, drain after the operation.

If there is reason to believe that one or both ureters have been tied, by reason of the anuria and the pain in the renal region and the flushed restless condition, the abdomen should be opened promptly and the ligatures cut; many lives have been saved by doing this.

If a substantial piece has been cut out of the ureter, and the upper end is long enough, an oblique vesical implantation is an excellent recourse. If the

The following are imperatives:

Cut no thickened white structure much like an empty vein, coursing oddly over the top of a growth, until it is traced back to the pelvic brim and separated from the ureter.

Look out for the odd elbow kink of the ureter at the side of the uterus where it is apt to be cut, Figures 451 and 452.

Begin, if necessary, by detaching the anterior peritoneal reflexion from the tumor below and gently work this loose, sliding it into the pelvis while sticking close to the tumor; in this way the ureter always drops out of

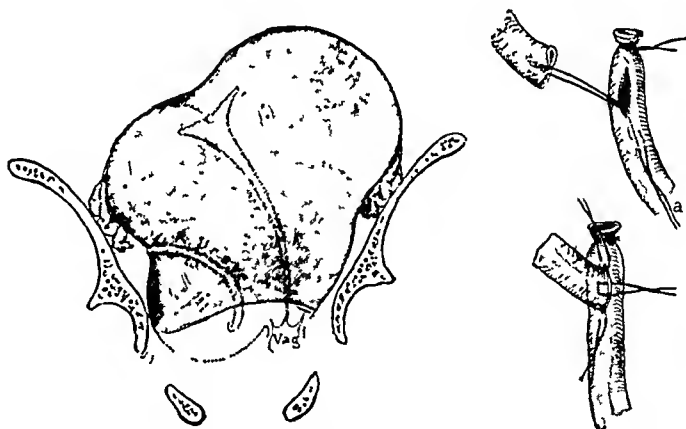


FIG. 452.—DISPLACEMENT OF RIGHT URETER LIGATED AND CUT. SUBSEQUENT ANASTOMOSIS.

Right ureter lifted high up on side of myomatous nodule mistaken for vein. Ligated and cut. Weller van Hook's method of anastomosis used to unite ends shown to right. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.)

end is not long enough to reach even by loosening and lengthening out the bladder, it is safe to tie the ureter securely with two ligatures and tuck it up under the peritoneum. Bear in mind that the ureter may be double and look for an accessory.

The routine examination of the field of operation before covering it up with peritoneum must include a careful investigation of the integrity of the ureters to obviate anxiety in the early convalescence.



FIG. 453.—COMPLICATED LARGE FIBROID TUMOR WITH ADHERENT BLADDER AND LARGE LEASHES OF VESSELS.

Above bladder, numerous sheets of adventitious adhesions cover lower anterior face of tumor. Just over retractor, right uterine tube is visible, and from its surface four well-defined adventitious vessels pass over to tumor. Omental vessels form most striking feature and omentum is everywhere adherent to anterior face of tumor, exhibiting vessels of enormous size. Operation. Recovery.

The relief of a hydronephrosis and hydro-ureter, when the pressure is taken off, is often the chief benefit of the hysteromyomectomy.

Such complications emphasize the importance of the urinary examination before operating, investigating the functional value of the kidney with sulphonephthalein and sometimes examining the blood for high nitrogen content. When any pyuria is found, it should be traced to its source, whether uretero-renal, pyonephrosis, or multiple abscesses of the kidney. One woman had a sloughing myoma and miliary abscesses of a kidney. The lifting of the compression of the ureters below, at whatever risk, is the only effective way to relieve and to clarify the serious situation. It is often astonishing to note the rapid recuperation of the urinary organs.

(b) *A d h e s i o n s*.—Adhesions in general occur in connection with myomata on an average of over 50 per cent and vary enormously in their degree from the slight velamentous attachments all the way up to an extensive fusion of the tumor with one or more of the adjacent viscera. Figure 453 shows extreme omental adhesions with great distention of the vessels, contributing largely to the nutrition of the tumor.

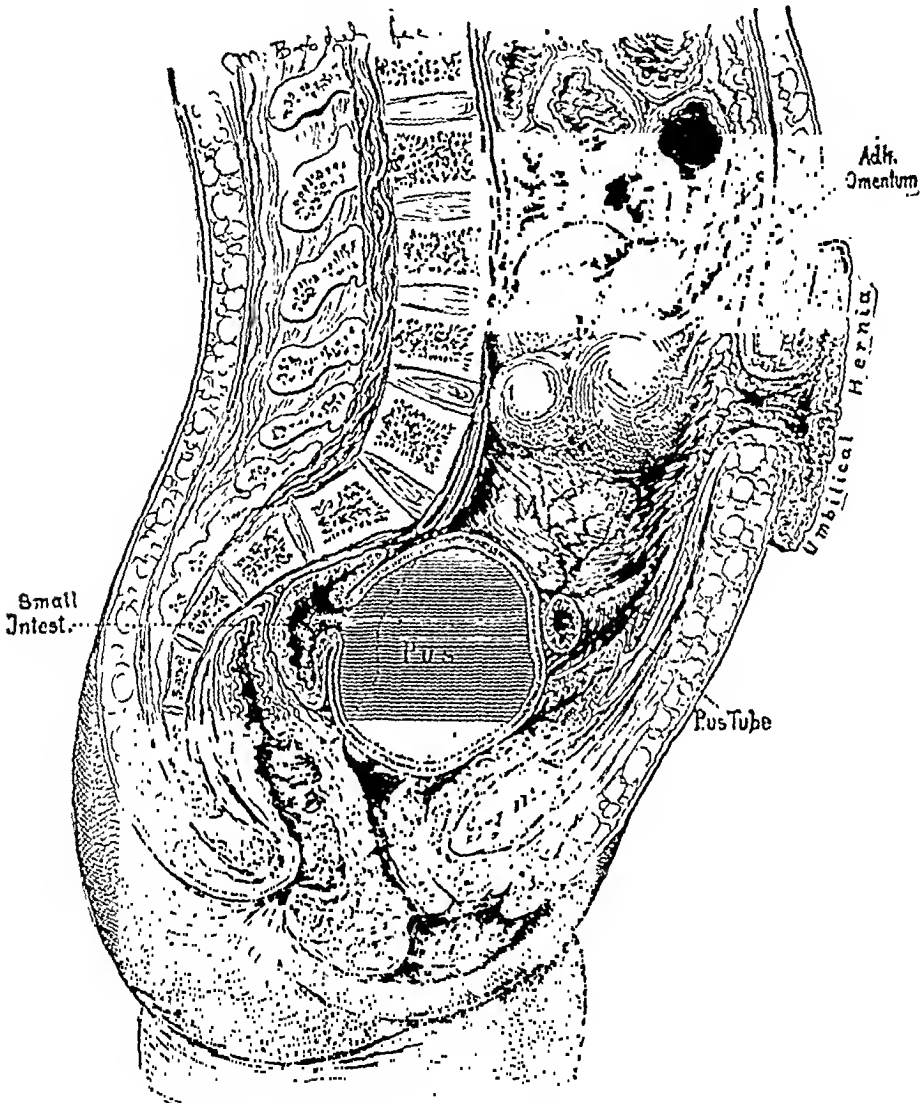


FIG. 454.—COMPLICATED HYSTEROMYOMECTOMY.

Abdomen filled with large myomatous uterus with intestinal and omental adhesions. There is an umbilical hernia, and on right side of pelvis a large abscess opening into small intestine. In front of abscess lies uterine tube full of pus. Enucleation. Recovery.

The worst and densest adhesions occur with tubal and ovarian abscesses and suppurating ovarian cysts, Figure 454. The most difficult to handle are those with the pelvic structures, where, owing to the limited space between the myoma and the pelvic walls and the density of the adhesions, concomitant with the thinning out of the septum between, say, a suppurating mass and the adherent viscus, one is apt to tear through into bowel or bladder, infecting the lower abdomen and leaving a nasty rent, sewed up with difficulty because

of the friability of the marginal tissues. Serious accidents in releasing adherent structures are usually avoidable by a slow deliberate painstaking detachment, never venturing beyond the borderline of certainty in effecting the separation and not trusting too much to the eyes in the finger tips in discriminating and following up lines of cleavage. Frequently, when the adhesion is particularly dense and the uterus is welded to rectum or small intestine, the way out is not to attempt to separate but to cut all around the adherent zone and to leave a thin shell of the uterus or myoma attached to the bowel. It is astonishing what excellent life-saving work can be done by careful trimming, suturing, and closing ragged openings.

The serious harm is often the undue prolongation of the operation; for this reason every reasonable precaution must be taken to avoid these complica-

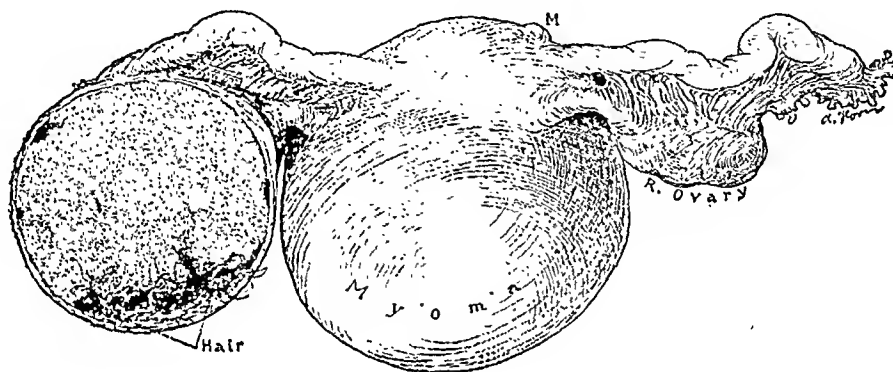


FIG. 455.—MYOMATOUS UTERUS WITH DERMOID CYST.

Seen from behind. Uterus with subperitoneal and interstitial myomata. Cyst in left ovary hardened and divided. Black hairs projecting below. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{1}{2}$.

tions. As an operator grows in experience, difficulties invariably become less numerous.

After-care calls for a thorough inspection and cleansing of the peritoneum and the disposal of the adherent and contaminated areas, as far as possible down in the pelvis, adjacent to a liberal iodoform gauze protective vaginal drain. Such a patient does well on a Gatch frame in a semisitting-up posture.

(c) Diseases of Tubes and Ovaries Associated with Uterine Myomata.—Complications involving uterine tubes and ovaries are surprisingly common. I quote statistics from *Myomata of the Uterus*, by Kelly and Cullen:

Out of 934 cases, in but 482 were both tubes normal. Dense tubal adhesions were present in 94 out of 423 in which both tubes adhered. Other complications were as follows: hydrosalpinx, 88; hematosalpinx, 12; chronic salpingitis, 48; pyosalpinx, 41; tubo-ovarian cyst, 5; tubo-ovarian mass, 5; tubo-ovarian abscess, 14; tuberculosis, 14, both tubes involved; tubal pregnancy, 6; rudimentary tube, 1; myoma of tube, 1.

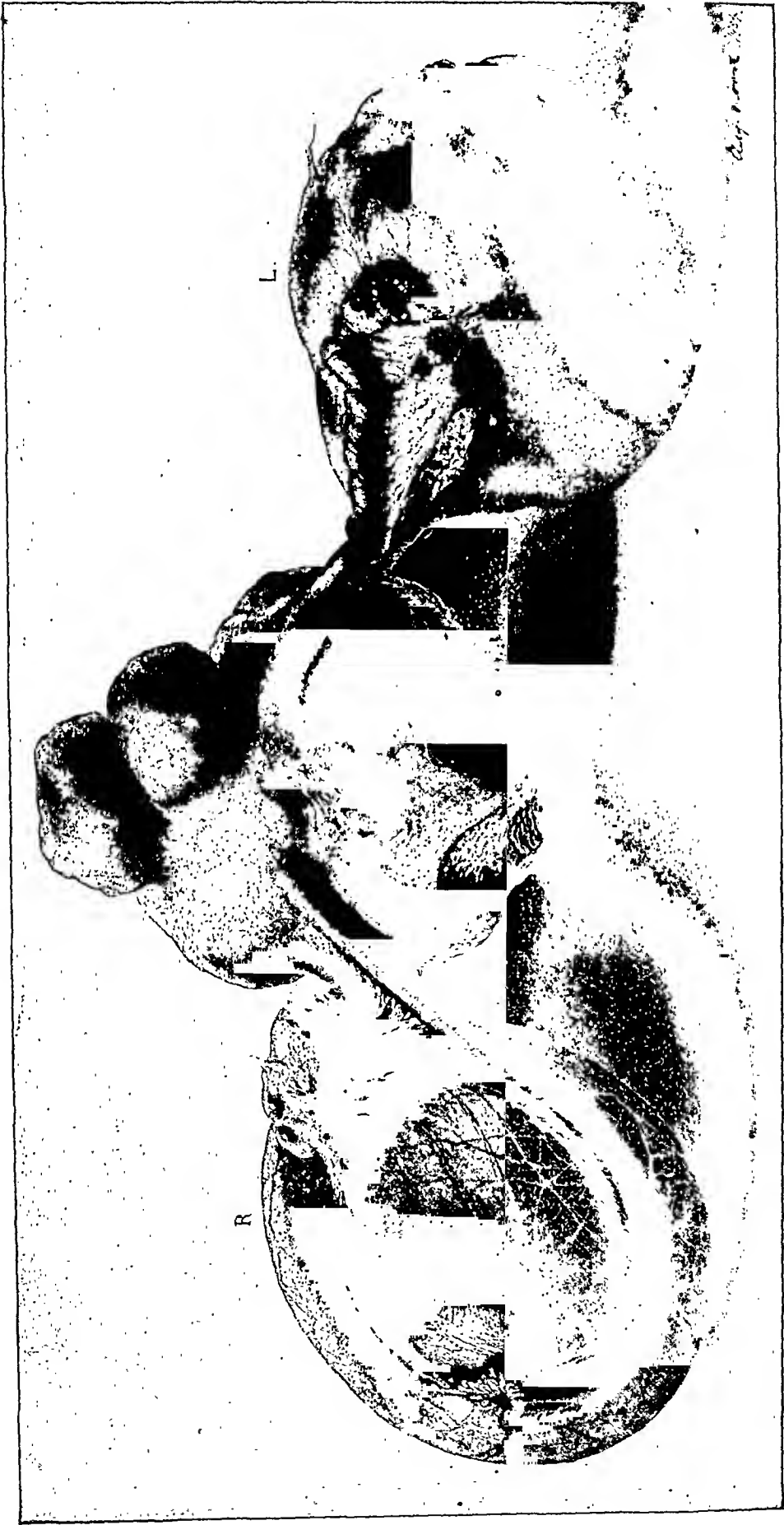


FIG. 456.—MULTINODULAR MYOMATOUS UTERUS; RIGHT PAROVARIAN LEFT DERMOID CYST.

Note characteristic relation of tube to parovarian cyst $8 \times 8 \times 10$ centimeters. Left ovary, $5 \times 7 \times 8$ centimeters, flattened by hardening of sebaceous material characteristic of a dermoid. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{5}{4}$.

Out of the 934 cases, also, the ovaries were normal in 438. In the remaining, more than half, they were either adherent or showed some pathologic lesion. In 95, adhesions were dense; the remainder, excluding those mentioned above, showed pyosalpinx, 6; pelvic peritonitis with abscess, 6; tuberculosis (primary in tubes), 3; small ovarian cyst, 44; graafian cyst, 68; corpus lutein cyst, 34;

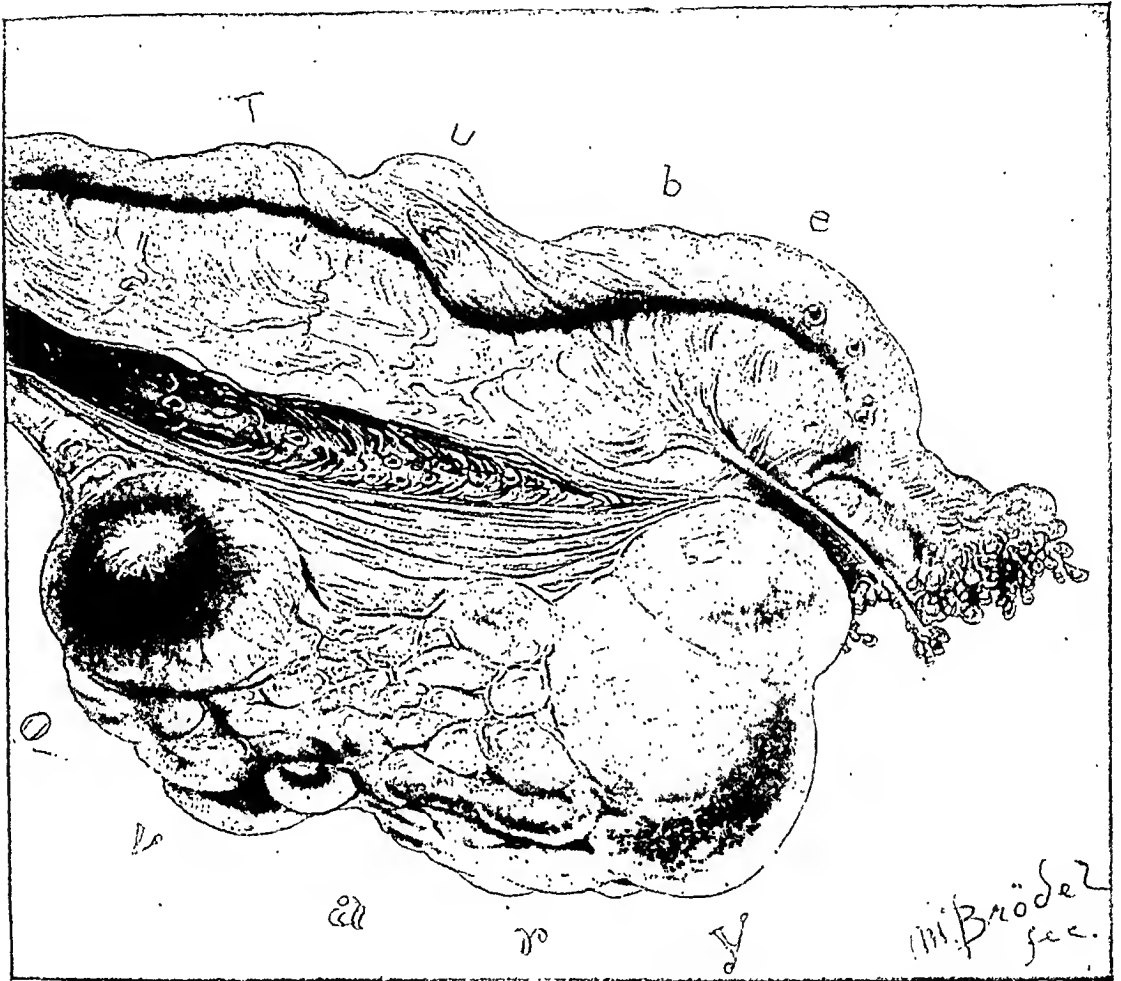


FIG. 457.—CHARACTERISTIC LARGE LEFT OVARY ASSOCIATED WITH MYOMATOUS UTERUS.

Tube greatly lengthened with bands of adhesions about middle. Ovary $9 \times 2\frac{1}{2} \times 4$ centimeters. Increase partly due to graafian follicles but solid portion coarse in texture and much increased. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times 1$.

cystadenoma, 9; papilocystoma, 12; adenocarcinoma, 8; dermoid cyst, 17; fibroma, 3; large ovary, 2; parovarian cyst, 19; myoma and ovary merged, 1.

All of these several complications are dealt with on the general principles applied to similar affections found in pelves with no myomata or where the myomata are so small as to be negligible. When the inflammatory masses are difficult and dangerous to enucleate, it is often wise, in case the myoma does not appear too vascular, to bisect the uterus down into the cervix, to amputate it there, and then inverting the cervix with a museau forceps to enucleate

first one half and then the other with or without the adherent and attached lateral structures which are generally more readily approached and detached in a direction from below on the pelvic floor upward. Sometimes, the easiest way is to bisect one large subperitoneal myomatous mass alone, releasing it

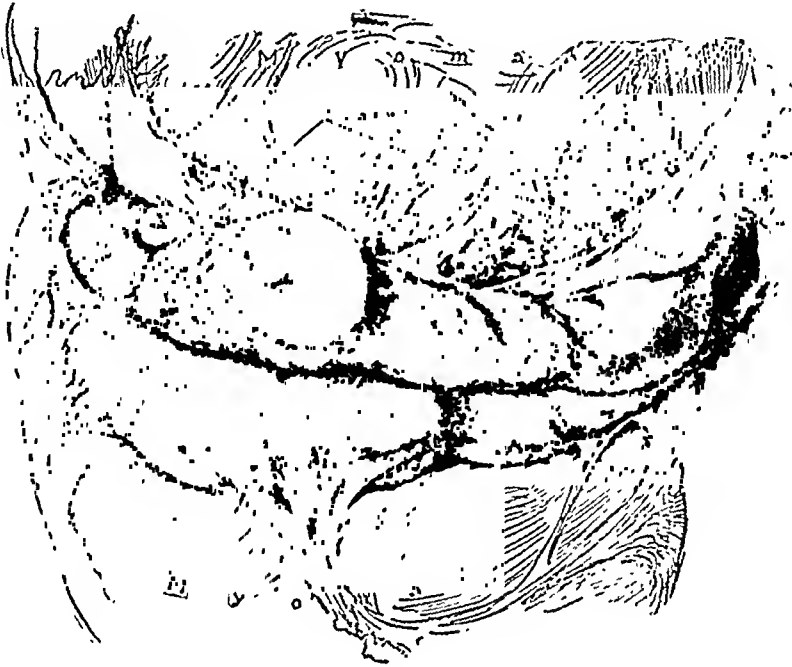


FIG. 458.—MYOMA WITH GREATLY LENGTHENED OVARY.

Tube and ovary wedged between myomatous masses above and below. Tube a large hydrosalpinx adherent to myoma. Ovary 13×3 centimeters. One graafian cyst. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times \frac{1}{2}$.

from the pelvis and creating abundant room in which to complete the enucleation under liberal exposure and with facile manipulations.

Where there is an abscess, particularly a large one, it is usually well to wall off the surrounding viscera and aspirate and evacuate it, then crowding gauze down over the hole made by the aspirator do the enucleation. A liberal vaginal drain follows.

CHAPTER XXXI
MALIGNANT TUMORS OF THE UTERUS
HOWARD A. KELLY

CARCINOMA

Cervix

INCIDENCE

ETIOLOGY

CLASSIFICATION

STRUCTURE

EXTENSION

Body

Tubes and Ovaries

Vagina

Bladder

Rectum

Parametrium

Pelvic Lymphatics

DURATION

Without Operation

After Operation

CAUSE OF DEATH

SYMPTOMATOLOGY

Bleeding

Leukorrhœa and Watery Discharge

Pain

DIAGNOSIS

TREATMENT

Body

INCIDENCE

EXTENSION

DURATION

CAUSE OF DEATH

SYMPTOMATOLOGY

DIAGNOSIS

TREATMENT

SARCOMA

INCIDENCE

CLASSIFICATION

Cervix

Body

SYMPTOMATOLOGY

DIAGNOSIS

TREATMENT

CHORIO-EPITHELIOMA

ETIOLOGY

STRUCTURE

*Macroscopic**Histologic*

EXTENSION

DURATION

SYMPTOMATOLOGY

DIAGNOSIS

TREATMENT

CARCINOMA

Two distinct forms of uterine cancer must be considered as to their anatomical sites. The commoner, arising in the cervix, running a rapid course, and speedily invading the neighboring parts by direct extension and by metastases, is usually seen too late for other than palliative treatment, while the radical operation done to remove it is attended with a mortality of from 5 to 10 per cent and exhibits a low percentage of permanent cures with a high rate of morbidity—infected incisions and ureteral and vesical fistulas. The other form, less frequent, arises in the body of the uterus, grows slowly, and often does not extend out beyond the uterus for some years; it is manifested by early clinical signs and its radical removal is attended with a low mortality and a high percentage of permanent recoveries.

W. H. Welch, writing on cancer of the stomach, has shown from an analysis of over 31,000 carcinomata from various sources that the uterus is oftenest affected primarily, constituting about one-third of all.

Of 11,382 patients admitted to the gynecologic clinic of the Johns Hopkins Hospital during its first fifteen years, 412, or about 3.5 per cent, had cancer of the uterine cervix.

CERVIX

Incidence.—The cause underlying ever remains obscure, while the disease grows commoner every year.

More than 94 per cent are over thirty; the number for the decades between thirty and fifty is fairly evenly distributed, the greatest incidence being between thirty-five and forty-five. My oldest patient was seventy, six were less than twenty-five, and three only twenty-two. It is obvious, therefore, that cancer of the cervix is a disease of middle life rather than of age.

It has been asserted repeatedly that while cancer of the uterus is frequent in whites, it is rare in negroes, but this is not substantiated. About 84 per cent admitted to my clinic were white, furnishing about 84 per cent of all admitted; 16 per cent were negroes who also furnished about 16 per cent of the admissions, showing about an equal prevalence.

Nor is it more prevalent among the poor than among the well-to-do, the same percentage being admitted to the private ward as to the public. The

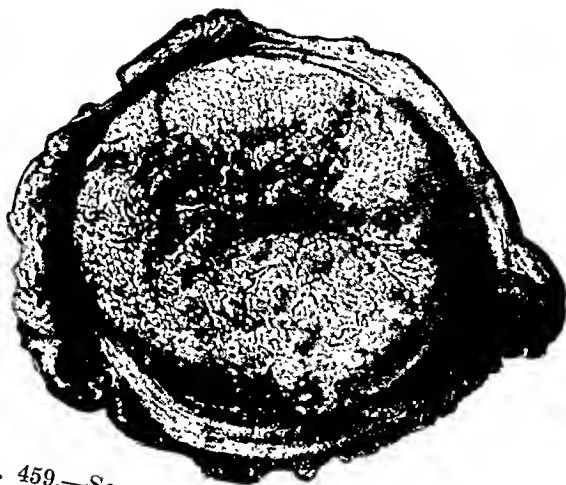


FIG. 459.—SQUAMOUS CARCINOMA OF VAGINAL PORTION OF CERVIX. EVERTING OR PAPILLARY FORM.

Both lips of cervix replaced by sessile, evertive, or papillary growth, bleeding easily on palpation. $\times 1$.

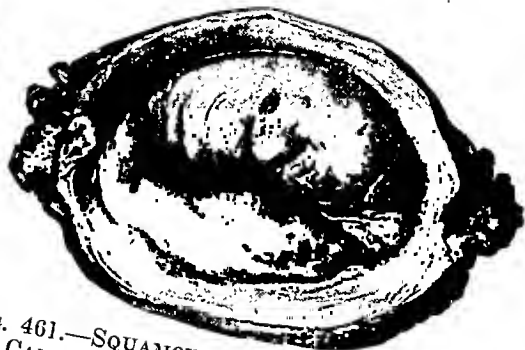


FIG. 461.—SQUAMOUS CARCINOMA OF CERVICAL CANAL; INVERTING FORM; SCIRRHOUS.

Growth apparently arising within canal. Just within external os, in anterior lip, cancerous tissue seen. $\times 1$.



460.—SAGITTAL SECTION OF SPECIMEN SHOWN IN FIGURE 459 (SLIGHTLY REDUCED).

Growth limited to vaginal surface of both lips of cervix, except where it has invaded deep structures of posterior lip for short distance.

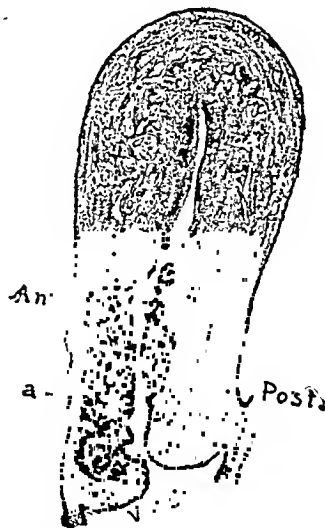


FIG. 462.—SAGITTAL SECTION OF UTERUS SEEN IN FIGURE 461 (SLIGHTLY REDUCED), DEMONSTRATING SQUAMOUS GROWTH WITHIN CERVICAL CANAL.

But little change in portiovaginalis. Growth ceases at internal os. *a* indicates junction of normal squamous epithelium and of cancer.

highest percentage of operable cases, however, occurred in the private wards, probably because this class is better informed and better able at once to consult a competent physician.

This affection rarely occurs in women who have never borne children. About 3 per cent of those with cervical cancers had never been pregnant, while 42 per cent of the body cancers were in nulliparæ. It must not be overlooked, therefore, that a cervical cancer can occur in a nullipara, and that even with an intact hymen.

Etiology.—The whole tendency of observation and experimentation for several decades has been to demonstrate that cancer in general often arises in

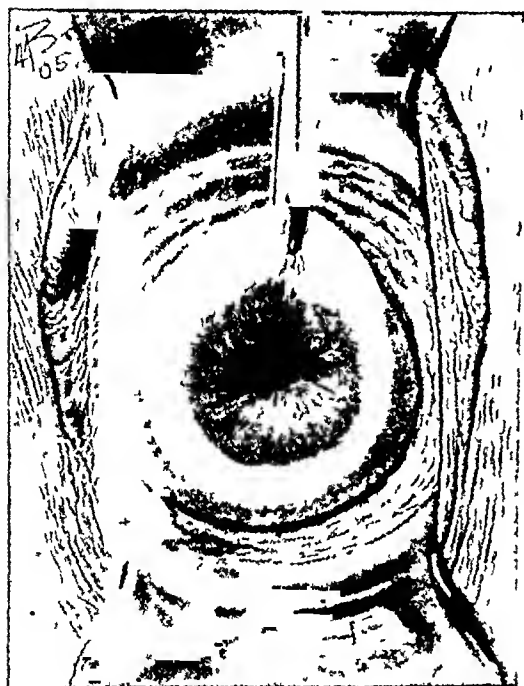


FIG. 463.—SO-CALLED EROSION. AN EXTENSION OF CERVICAL MUCOSA BEYOND EXTERNAL OS OVER VAGINAL PORTION. $\times 1$.

a focus of repeated irritation, mechanical or chemical, as a direct provocative cause, illuminating the common observation that childbirth is an important factor. From over forty years of clinical observations, I am convinced that the trauma of pregnancy, followed by an infection of the cervix with thickened lips, eversion of the mucosa, and a constant mucoid or mucopurulent discharge, will account for a large number of these cases. For this reason, I make a point in every instance either of wiping out the diseased mucosa thoroughly with the actual cautery (*cuprum candens*), or, if any radical operation as in fibroid tumors or pelvic infections is indicated, of removing the entire cervix with the uterus, where the cervix appears unhealthy (Chapter XVI).

Classification.—Cervical cancers may be subdivided anatomically into two main groups: Those arising from the visible vaginal portion and those arising within the canal. The practical importance of such a classification becomes apparent when we compare Figures 459 and 460 with Figures 461 and 462, where it is evident that the disease affecting the vaginal portion should be detected early by the physician who first examines, both because it is more apt to give rise to symptoms earlier and because it can be recognized at once on inspection.

The vaginal portion of the cervix is normally covered by stratified epithelium, continuous with the vaginal walls and usually ending at the external os; it sometimes extends, however, up the cervical canal for a variable distance. The canal, on the other hand, is lined by high cylindrical cells, usually joining the stratified epithelium at the os but often extending beyond its usual

limits and encroaching upon the vaginal portion, thereby producing a so-called "erosion of the portiovaginalis," Figure 463. Cancers springing from these two varieties of epithelium manifestly always differ histologically and, sometimes, clinically. The squamous-cell cancers, springing from the stratified epithelium, are in a sense more important because more frequent, Figure 465.

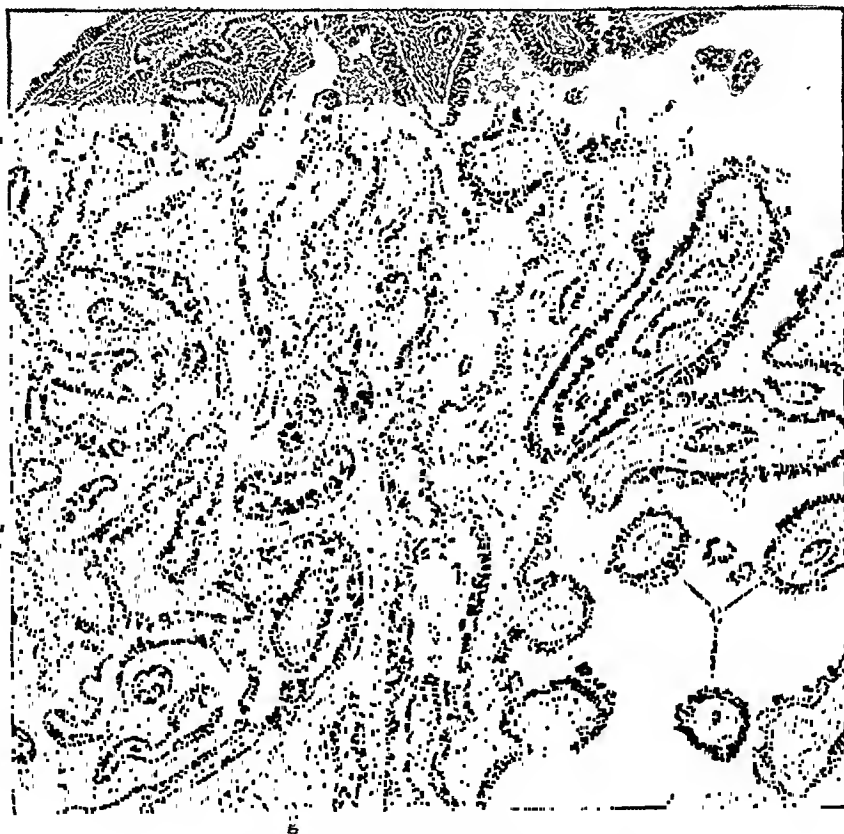


FIG. 464.—ADENOCARCINOMA OF CERVIX.

Section from surface of growth showing picture seen in a curettage in this for *a* and *b*, main trunks; *a'* and *b'*, terminals; *c*, sections of terminals; *d*, epithelium in layer *e*, one layer in chinks; *f*, glandlike infolding of stroma; *g*, stroma. Epithelial cells have small, uniform, deeply staining nuclei. (T. S. Cullen.)

Structure.—Cervical cancers are divided histologically into the squamous and the cylindrical-cell or adenocarcinomata, according as one or the other form of epithelium characterizes the growth.

The histologic varieties of cervical cancer thus distinguished can often be grouped according to the morphology as everted or inverted. We can say why a particular growth "everts" and forms a papillary or cauliflower mass, Figures 459 and 460, while another, identical histologically, "inverts" to form a nodule in the cervical wall with but scant evidence of its presence at the surface, Figure 461. Further, the malignant process may be well circumscribed in one, and in another, apparently the same type, diffusely scattered.

There are intermediate forms and sometimes both processes in the same



FIG. 465.—PARTIAL OBLITERATION OF CERVICAL GLAND BY SO-CALLED SQUAMOUS CARCINOMA OF CERVIX.

a, upper third of normal cervical gland. *b*, stroma invaded by squamous epithelium. Nuclei of epithelium stain deeply, several, (*c*) large, containing excess of chromatin. Epithelium extends well into gland, *d*. Nuclei closely packed and staining deeply, and many enlarged, irregular, *e*, and contain much chromatin. *f*, cross sections of normal gland folds. Character of squamous epithelium makes diagnosis of carcinoma certain. (T. S. Cullen.) $\times 90$.

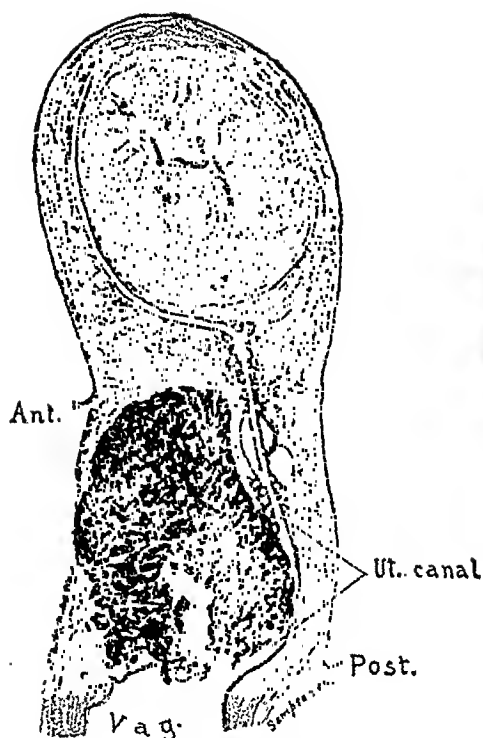


FIG. 466.—SQUAMOUS CARCINOMA OF VAGINAL PORTION OF CERVIX: INVERTING OR INFILTRATING FORM; MEDULLARY WITH NECROSIS.

Sagittal section of uterus slightly reduced. Primary growth limited to anterior wall of cervix, replacing and enlarging it and compressing posterior wall. Necrosis in anterior lip.

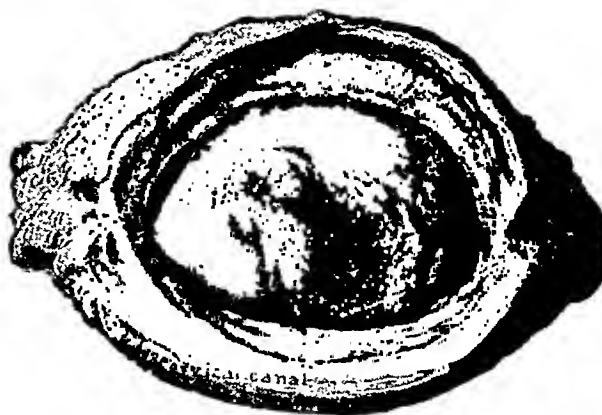


FIG. 467.—CERVIX OF SPECIMEN IN FIGURE 466.

Growth replaces anterior lip of cervix and pushes external os posteriorly. Necrosis with ulceration has appearance of cervical canal lined with cancerous tissue. $\times 1$.

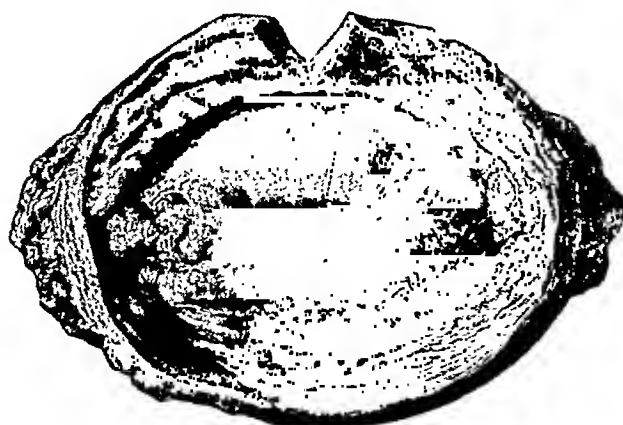


FIG. 469.—CERVIX OF SPECIMEN IN FIGURE 468.

Growth apparently begun in posterior lip. Necrosis with consequent sloughing, resulting in ulcerated cancerous process, involving posterior lip and lateral portions of anterior. $\times 1$.

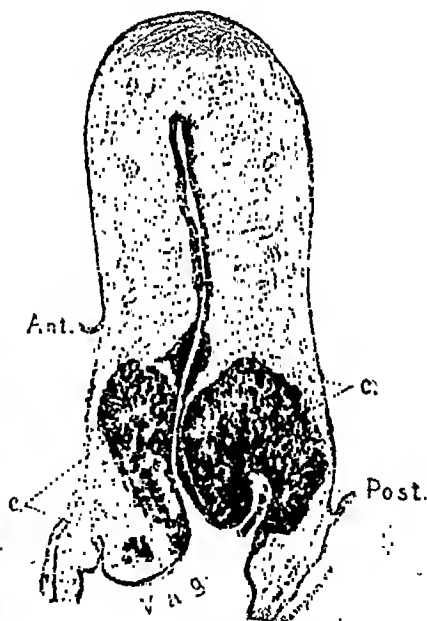


FIG. 468.—SQUAMOUS CARCINOMA OF VAGINAL PORTION OF CERVIX: INVERTING OR INFILTRATING FORM; MEDULLARY WITH NECROSIS.

Sagittal section of uterus slightly reduced, showing possibly a later stage of the disease than in Figure 466. *cc* is cancer which has invaded the deeper cervical tissues and has surrounded the canal.

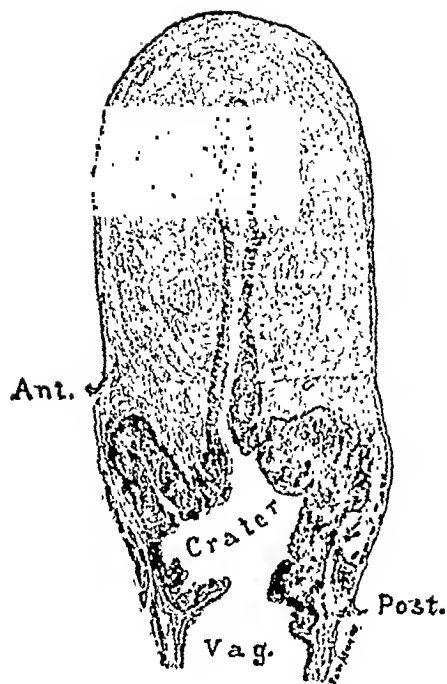


FIG. 470.—SAME TYPE OF GROWTH AS SHOWN IN PRECEDING ILLUSTRATION, BUT LATER STAGE.

Sagittal section of uterus slightly reduced, showing more advanced stage of disease than in Figs. 466 and 468. Growth surrounds cervical canal, necrosis has occurred and central portion sloughed away, converting cervix into shell lined by necrotic cancerous tissue.



FIG. 471.—CERVIX OF THE SPECIMEN SHOWN IN FIGURE 470.

Exact origin of growth not determined. External os replaced by craterous opening lined by necrotic cancerous tissue. Disease has spread over a portion of vagina on left side. $\times 1$.

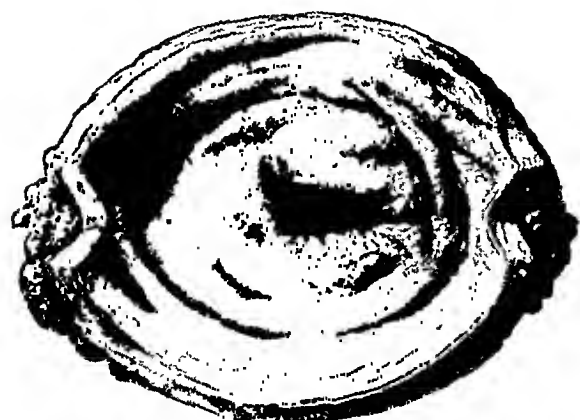


FIG. 473.—CERVIX OF THE SPECIMEN SHOWN IN FIGURE 472.

Growth apparently arisen within canal and caused induration, retraction, and a puckering of vaginal portion of cervix. $\times 1$.

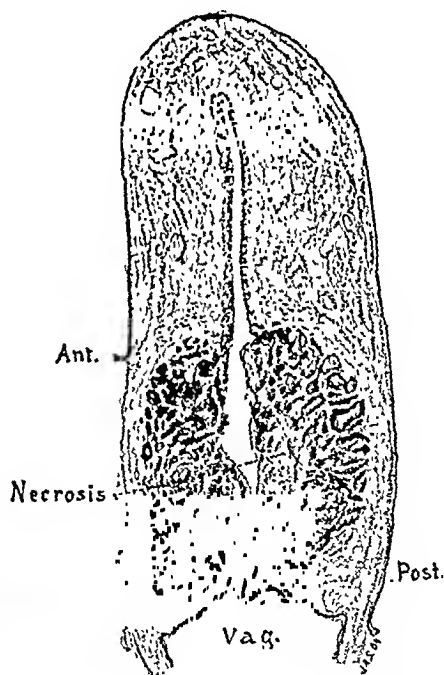


FIG. 472.—SQUAMOUS CARCINOMA OF CERVICAL CANAL: INVERTING FORM; MEDULLARY WITH NECROSIS.

Sagittal section of the uterus slightly reduced. Growth has started within cervical canal and has replaced greater portion of cervical tissue. Necrosis has occurred and soon central portion would have sloughed away converting cervix into a shell lined by cancerous tissue.

specimen. The different forms can generally be grouped according to the predominant type of growth, as:

1. Everting or vegetative (synonyms: cauliflower, papillary, proliferating)
2. Inverting or infiltrating (synonyms: nodular, ulcerative, parenchymatous)

The everting or vegetative form, springing from the vaginal portion, is usually squamous-cell and broadly pedunculate or sessile. As it grows, the free portion becomes more massive while the base invades the underlying tissues. The visible tangible portion greatly distends the cervical canal and even fills the vagina. Just here is a paradox; namely, that with a vast external manifestation there may be but little lateral invasion. The unwary may be misled by this, when the outward manifestation is but slight, to conclude that the deeper tissues are likely to be free.

The inverting or infiltrating form seems to turn itself up into the cervical tissues and usually forms a more or less circumscribed mass with fine cancerous processes radiating out into the surrounding peripheral tissues, Figures 466, 467, 468 and 469. As the cancer progresses it becomes necrotic and ulcerating; with further advance, the entire cervix may melt down and leave only a thin shell, Figures 470 and 471.

In the scirrhus form, there is less sloughing as the increased stroma nourishes the growth.

The inverting cancer unfortunately often gives rise to no marked symptoms until well-advanced, and its detection by inspection or palpation is not obvious until the necrotic stage is reached.

Cancer within the cervix may be either squamous- or cylindrical-cell, with changes similar to the vaginal portion. In Figure 462 is the inverting squamous-cell scirrhus type, arising in the cervical canal, and in Figures 472, 473 and 474 we see the inverting squamous-cell medullary type with necrosis from the same site. In Figure 474, the cylindrical-cell variety which arises more frequently in the canal is shown with the vaginal portion intact, while the cervix above is converted into a mere shell.

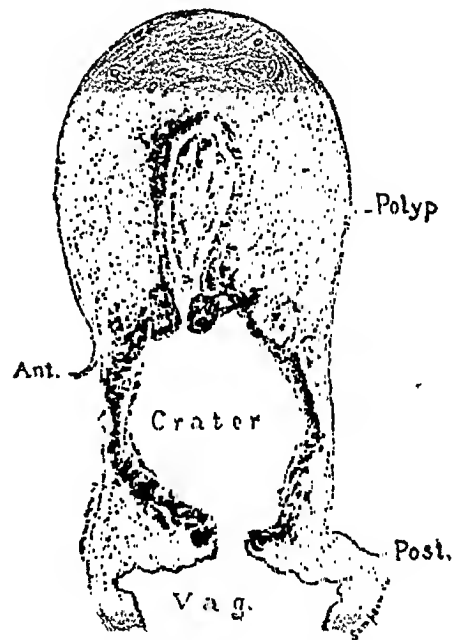


FIG. 474.—SAME TYPE OF GROWTH AS IN FIGURE 472, BUT LATER STAGE.

Sagittal section of uterus slightly reduced. Center of cervix has sloughed away, converting cervical canal into craterous cavity, lined with cancerous tissue. Uterine body is being invaded by growth. Internal os usually marks upper limit of growth.

Extension.—In twenty-seven specimens studied by J. A. Sampson, a thin sagittal section was removed, Figure 468, and the parametria and attached portions were cross-sectioned as in Figure 475, and by these the extensions upward and outward were determined and a reconstruction made demonstrating both the form and the relation of the growth to the uterus, Figure 476.

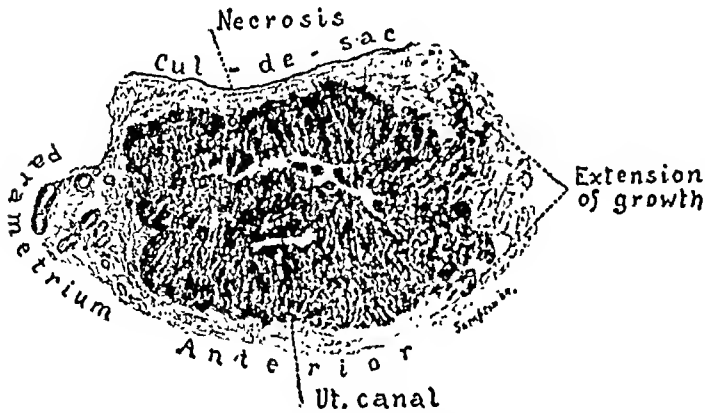


FIG. 475.—SQUAMOUS CARCINOMA OF VAGINAL PORTION OF CERVIX: INVERTING; MEDULLARY WITH NECROSIS.

Cross-section slightly reduced taken at level 3-4 in Figure 476. Necrosis with sloughing is beginning to take place in cancerous tissue posterior to cervical canal. Growth has invaded left parametrium as fine cancerous processes along nerve sheaths.

In nineteen the pelvic lymph-nodes were studied and cancer found in nine, or 47 per cent. There is no demonstrable relation between the size of the primary growth and the occurrence of metastases. See, for example, Figure 477, where with a large primary growth there are no metastases, and Figure 478, where the primary growth is

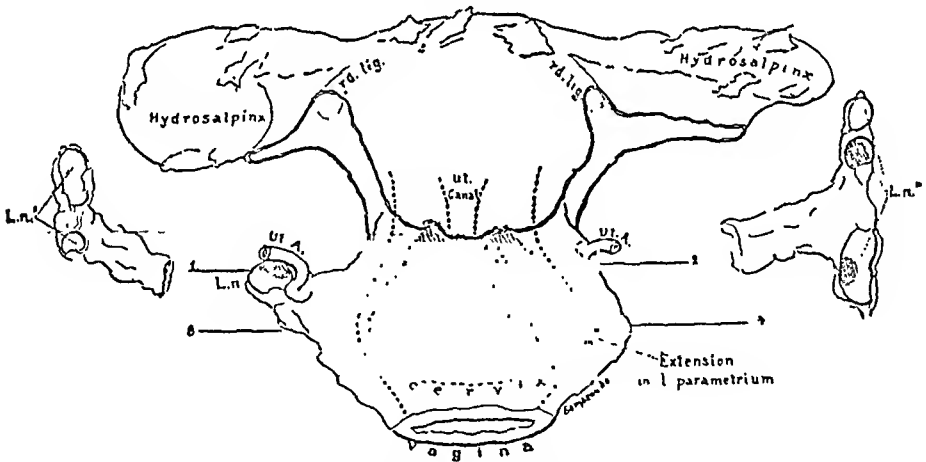


FIG. 476.—APPROXIMATE RECONSTRUCTION SHOWING RELATION BETWEEN CANCER AND SPECIMEN REMOVED AT OPERATION IN EXTENSIVE LOCAL GROWTH. SAME TYPE AS IN FIGURES 468, 469, 475, AND 485.

Primary growth well within cervix except on left side, where it extends into parametrium (Fig. 475). Cancer has metastasized to parametrial lymph-node on right side (see Fig. 485), which may have prevented further spread of disease on that side. This node absent on left where disease has metastasized to iliac nodes *L.n.*

small and the parametrium intact but the disease has skipped into the iliac nodes, Figure 479. This has an important practical bearing, teaching us that some of the extensive primary growths can be cured by a wide excision, while some of those apparently favorable are incurable.

Body of the Uterus.—The level of the internal os usually marks the limit of the upward extension. The body becomes involved only late in the disease by direct extension through the deep tissues of the uterine walls, Figure

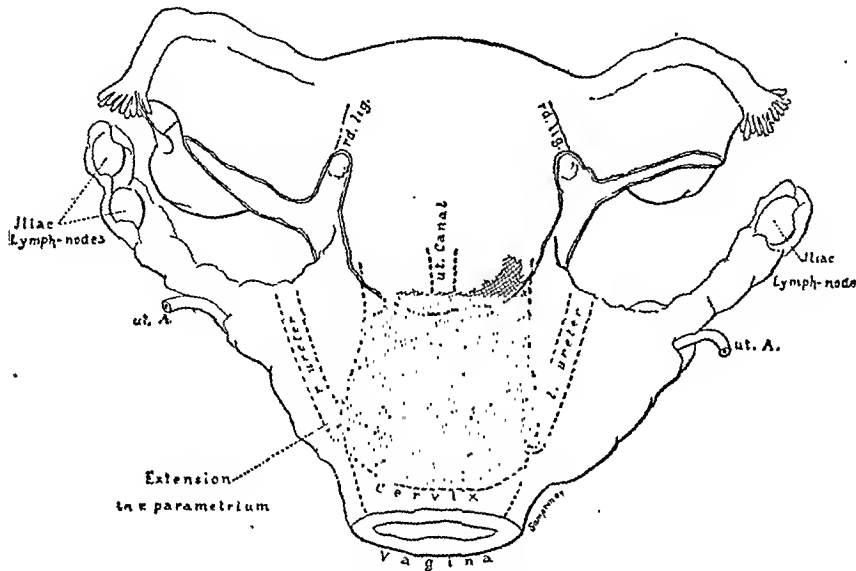


FIG. 477.—APPROXIMATE RECONSTRUCTION AS IN FIGURE 476.

Same type of growth as in Fig. 478, only more extensive locally. Widespread local growth necessitated resection of lower portion of both ureters, yet iliac nodes removed were free from cancer. Extensive primary growth, therefore, not always indication that metastases have occurred. $\times \frac{1}{2}$.

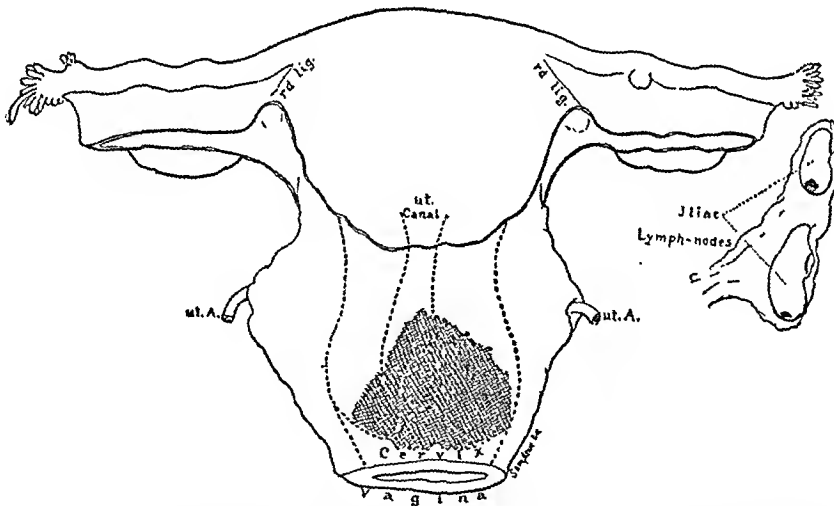


FIG. 478.—APPROXIMATE RECONSTRUCTION, SHOWING RELATION BETWEEN CANCER AND SPECIMEN REMOVED AT OPERATION, IN SMALL PRIMARY GROWTH WITH METASTASES TO PELVIC LYMPH-NODES.

Squamous carcinoma of vaginal portion of cervix: inverting; medullary with necrosis. Apparently early primary growth, limited to cervix, does not exclude metastases to pelvic lymph-nodes as shown in sketch to right. $\times \frac{1}{2}$.

477. The growth less frequently creeps up over the mucosa of the cavity, and metastases either to mucosa or walls are rare, Figure 480.

Tubes and Ovaries.—These structures are rarely involved and then only in advanced cases.

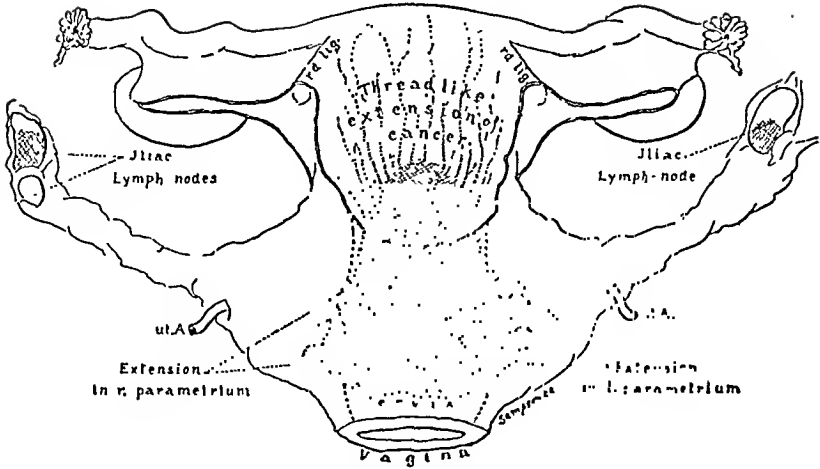


FIG. 479.—APPROXIMATE RECONSTRUCTION AS IN FIGURE 478.

Squamous carcinoma of vaginal portion of cervix; medullary with necrosis.

Direct extensions in both parametria as threadlike processes and into body of uterus *en masse*. Metastases in pelvic lymph-nodes of both sides. $\times \frac{1}{2}$.

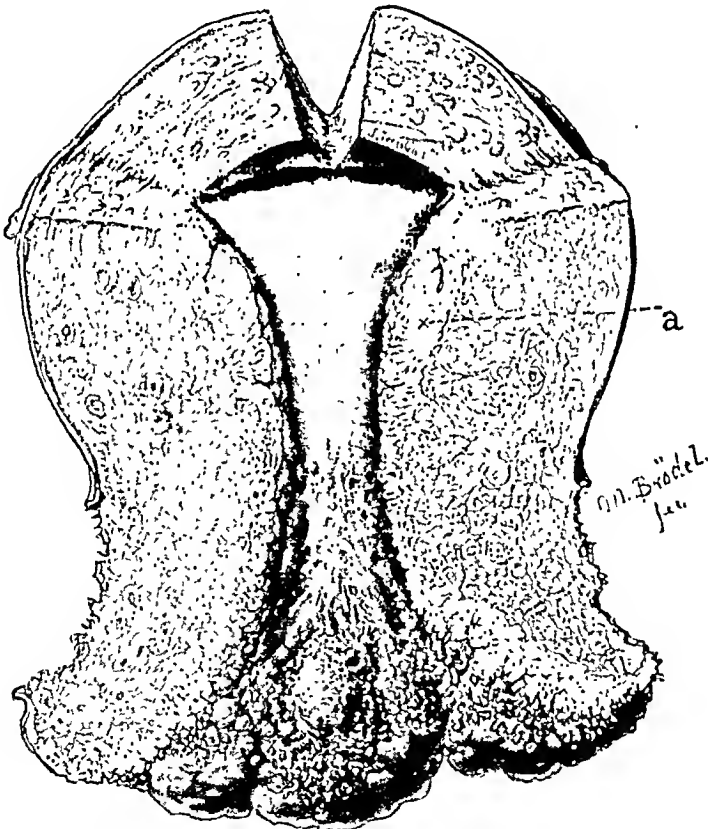


FIG. 480.—ADENOCARCINOMA OF CERVIX WITH EXTENSION TO A POLYP (a) AND TO BOTH UTERINE HORNS.

Demonstrates the wide distribution of an apparently early local growth. (T. S. Cullen.) $\times 1$.

Vagina.—The vagina frequently participates by a direct extension. The growth also advances through the deeper tissues of the vaginal wall to form submucous lumps and indurations, appearing later on the surface as an ulcer. Another form of vaginal involvement is an “implant” which, however, may

not be a true implantation but due to a retrograde lymphatic metastasis or a direct extension along a lymph channel.

Bladder.—The bladder is oftener involved and at an earlier period than the rectum. Anatomical relations seem decisive here, for while the anterior cervix

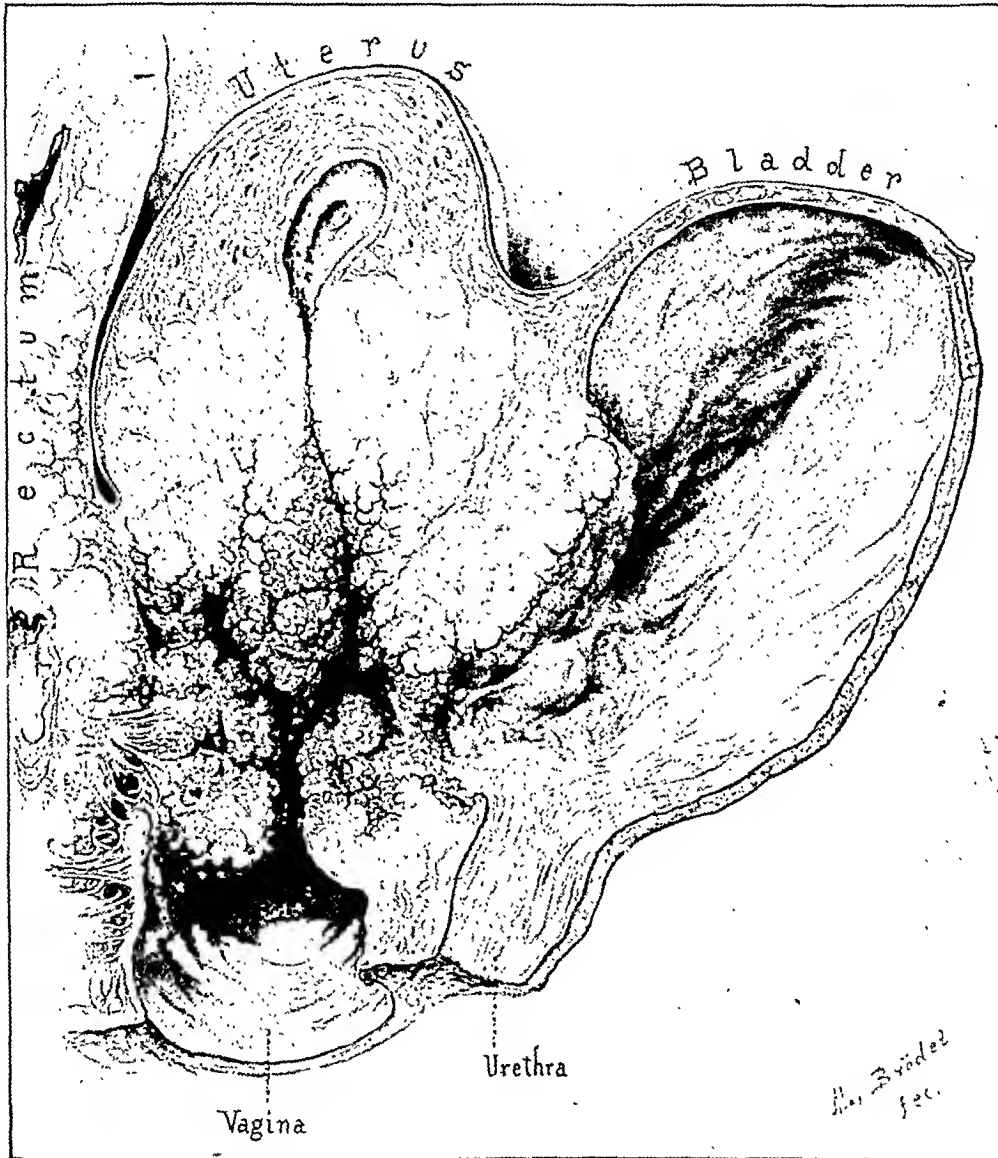


FIG. 481.—SQUAMOUS CARCINOMA OF CERVIX WITH EXTENSION TO BLADDER AND RECTUM. VESICOVAGINAL FISTULA.

Sagittal section of bladder, uterus, and rectum. Disease extends in all directions; with necrosis of growth vesicovaginal fistula has formed. (T. S. Cullen.) $\times 1$.

rests against the bladder, posteriorly it is separated from the rectum by the deep culdesac.

Rectum.—Rectal involvement is usually late and associated with the obliteration of the culdesac, facilitating direct transference, or the advance is along the posterior vaginal wall, Figure 481.

Parametrium.—The parametrium forms a blood-vascular lymphatic hilum of the cervix through which the main lymph channels course to the pelvic

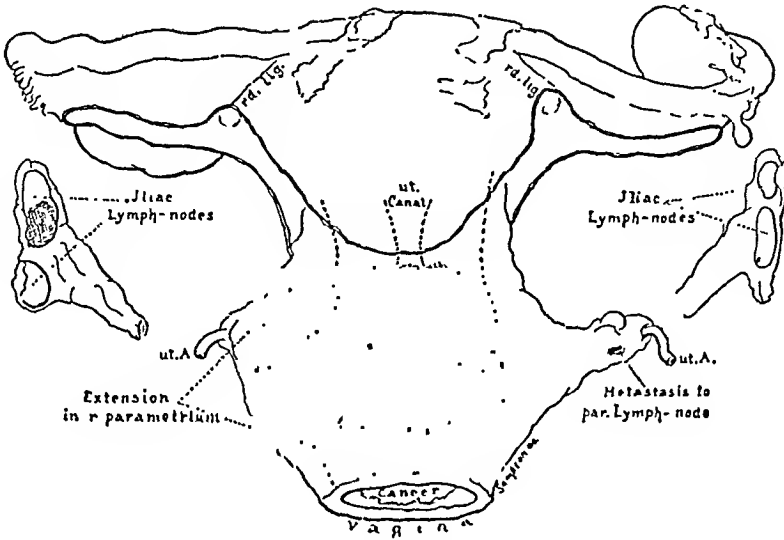


FIG. 482.—APPROXIMATE RECONSTRUCTION SHOWING RELATION BETWEEN CANCER AND SPECIMEN REMOVED AT OPERATION IN EXTENSIVE LOCAL GROWTH.

Squamous carcinoma of vaginal portion of cervix; inverting form; scirrhus. Disease invaded both broad ligaments and posterior vaginal wall and extended about 2 centimeters below cervix. Metastases to iliac lymph-nodes on both sides and to parametrial lymph-node on left. $\times \frac{1}{2}$.

nodes; here we usually find the first advance as the growth advances beyond the limits of the cervix whether by direct extension or by metastasis. Out of

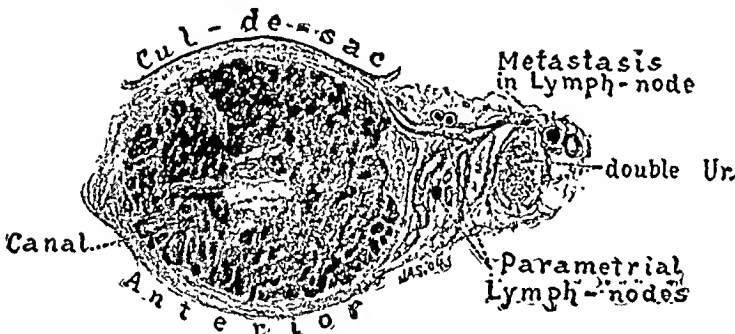


FIG. 483.—SQUAMOUS CARCINOMA OF CERVICAL CANAL: INVERTING FORM; MEDULLARY WITH NECROSIS.

Cross section slightly reduced, taken about middle of cervix. Four small lymph-nodes protrude into lymph channels like sponges. Cancer metastasized to one situated lateral and posterior to double ureter. Same specimen as in Figures 461 and 472.

the twenty-seven cases, the parametrium was involved, either by direct extension or by metastases, in seventeen, in fourteen of which the direct cervical extension was either in the form of delicate processes, Figure 476, or massive, Figure 482. In nine there were metastases in the parametrial lymph structures; in one the cancer was in the lymph channel itself. In eight, the cancer

cells had traversed through the lymph channels, leaving no trace behind and lodging in a node.

There are three types of parametrial nodes, in which a metastasis may lodge:

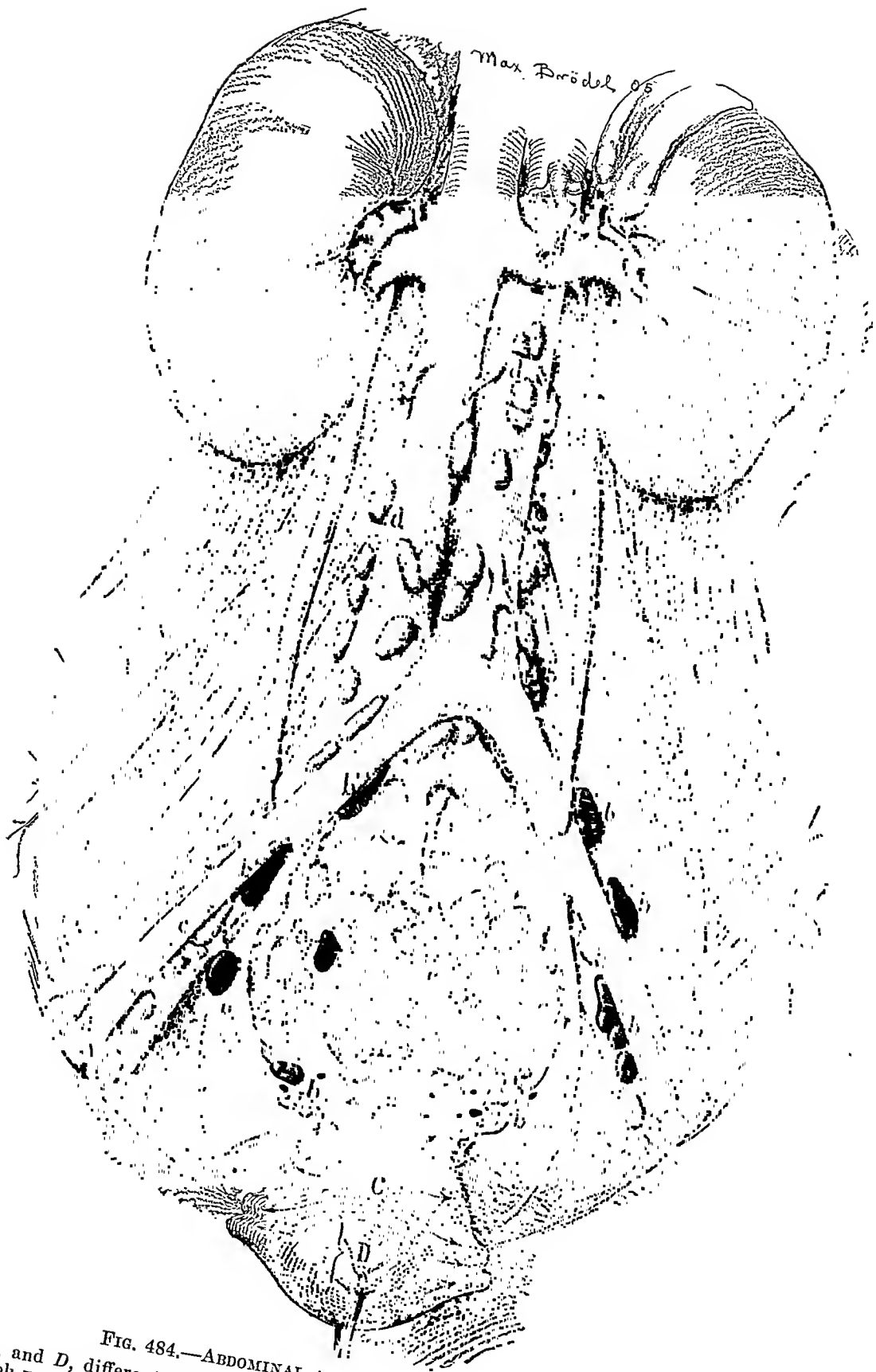


FIG. 484.—ABDOMINAL AND PELVIC LYMPH-NODES.
A, B, C, and D, different portions of uterus; *a, b, c, and d*, lymph-nodes, which usually receive lymph vessels coming from these portions. Dark nodes (including minute parametrial lymph-nodes) represent those most frequently involved in cancer of cervix.

1. A relatively large lymph-node occasionally found near the site where the uterine artery crosses the ureter, as in Figure 483.

2. Small lymph-nodes of varying size and number, differing in no way from those found elsewhere.

3. Another type apparently in the wall of a main channel and protruding into its lumen like a sponge, as in four of the twenty-seven cases in three of which the cancer had formed metastases to one or more of the nodes; its significance is not known but it undoubtedly helps check the extension of the disease, Figure 483.

The parametrial invasion in the form of threads or metastases shows how impossible it may be to determine clinically the fact of an extension; it also emphasizes the importance of a wide excision.

Pelvic Lymphatics.—The glands, Figure 484, are not affected in as large a percentage as we once thought.

G. Winter, after numerous examinations of women dying either after operations for cervical cancer or from recurrences, concluded that infected

glands are extremely rare so long as the disease is limited to the uterus and that even when the parametria become involved, only in about a third of all cases are the glands infected. These observations clearly throw the stress of the operation upon the removal of the uterus, with as much as possible of the adjacent parametrial tissues, as the most likely way of preventing recurrence.

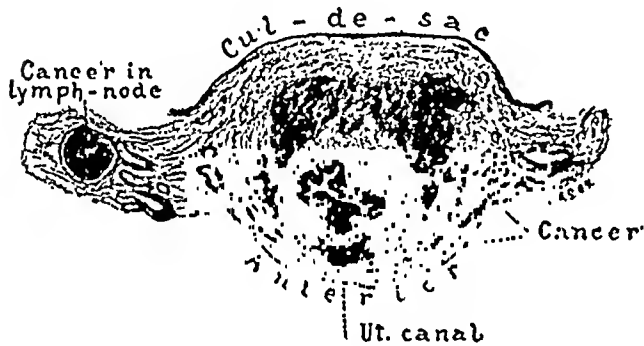


FIG. 485.—FROM SAME SPECIMEN AS FIGURE 475.

Cross section slightly reduced, taken just below level of internal os. Note invasion of cervical tissues about cervical canal. Cancer metastasized to lymph-node in right parametrium.

The primary growth may be small and yet metastatic, Figure 485; also, an enlarged lymph-node is not necessarily cancerous, while a small node is not necessarily free. Only by the microscope dare we declare that there is no disease lodged in the lymphatics.

While noting the three types of parametrial lymph-nodes which may check the disease, it may still run the gauntlet of this sieve and metastasize in the iliac lymph-nodes, leaving the parametrium free, as in Figure 478.

E. Wertheim noted that the disease always recurred when the lymph-nodes were found involved at operation, so he held that the removal of the lymph-nodes was of prognostic value only, an opinion concurred in by J. G. Clark who was early in advocating their removal (*Johns Hopkins Hosp. Bull.*, 1895, 6).

The abdominal and pelvic lymphatics of three patients, dying after operation for cancer of the cervix, were studied by Sampson. While they were

extensive primary growths, the pelvic and abdominal lymphatics were free in two and in the third only three lymph-nodes were involved, one situated above the bifurcation of the aorta, demonstrating that it was operatively curable.

It seems fair to conclude that the percentage curable by removing the involved pelvic nodes is so small that it may easily be exceeded by the increased primary mortality of the severe prolonged operation. However, if at the close of the local operation the condition of the patient is good, the removal of the easily accessible iliac lymph-nodes may be undertaken for their study.

Coagulation endothermy (Chapter XLVIII) here offers a new hope in the rapid destruction of all suspected discoverable glands on the pelvic floor and lateral walls or higher, provided they are not so numerous as to make the effort obviously hopeless. By turning on a heavy current and inserting the needle in two or more places in each gland, the entire interior is destroyed, sterilized, and left *in situ* to be absorbed. This involves no such additional risk as an extirpative operation, since the delay is merely the matter of a few minutes.

Duration.—*Without Operation.*—Of ninety of my inoperables, about one-third died within a year and but few lived over three years. It is generally believed that the disease runs a more rapid course in the young, an opinion substantiated by this group. We also note that disease developing within the cervix extends out into the broad ligament earlier than when it arises on the vaginal portion.

With Operation.—An important practical question often asked is how operation affects the duration of the disease if it recurs.

Out of sixty, the date of whose deaths we know, thirty-four lived over one year after the operation and eight lived over three years. Several were relieved for over a year, feeling "as well as they ever felt" during that time, and four were relieved for over three years. I believe that the relief usually justifies the operation.

Death is easier in the "recurrences" from the metastases in the lymph-nodes than from a local recurrence, again emphasizing the importance of wide excision of the primary growth and the avoidance of implantations.

Cause of Death.—The place of origin of the growth, its type, direction, and mode of extension determine the cause of death. The occurrence and extent of necrosis also profoundly influences the course of the disease. A few die from hemorrhage from the erosion of large pelvic vessels.

In many, the immediate cause of death is a terminal infection. The patient becomes cachectic from the repeated losses of blood, the absorption of toxins from the necrotic areas, and the renal insufficiency due to the compression of the ureters, Figure 486; then, fortunately, a terminal infection steps in to close the protracted painful scene. Many die from renal insufficiency alone, due to compression of the ureters by the extension into the broad ligaments.

Other causes of death are intestinal obstruction and embolism.



FIG. 486.—DOUBLE HYDRO-URETER DUE TO ADVANCED CANCER OF CERVIX.

Atrophic and inflammatory changes due to cancer plainly visible in adhesions of bladder to uterus, and in cicatricial tissue and adhesions between ureters and about kidneys. $\times \frac{3}{4}$.

Symptomatology.—So long as the cancer remains restricted to the cervix, it usually gives rise to but two principal local symptoms; namely, bleeding and a watery or a foul leukorrheal discharge, sometimes with associated constitutional symptoms. With extension beyond the cervix, other symptoms arise, depending upon the nature of the extension and the parts involved. Pain due to the cancer occurs late and is sometimes absent.

Bleeding was present in some form in about 93 per cent of 412 cases in the Johns Hopkins Clinic, sometimes "only a show" at intervals, as on exertion, after coitus, taking a douche, or straining at stool. In others, it was slight but more constant, soiling the clothes. Sometimes, on the other hand, the hemorrhage is profuse, resembling a prolonged or freer menstrual flow, an irregular menstruation, or a return of the menses after the menopause—a "rejuvenation" as an elderly woman sometimes imagines. Again, the case may be characterized throughout by severe, even frightful hemorrhages. Hemorrhage is fortunately an early symptom, readily noticed, to which immediate attention should be given both by the patient and doctor.

Leukorrhea and watery discharges may occur early but frequently escape notice until the discharge becomes profuse, blood-tinged, offensive, or irritating. When foul and offensive, it usually indicates extensive growth with necrosis. Vulvar pruritus is often associated with a discharge.

Pain is apt to be late and may be wanting. When present, it may be due to a coincident pelvic inflammatory disease, associated with or independent of the malignant process. A pyometra from cervical occlusion may also give rise to a pyosalpinx, Figure 487, occasioning much pain and aching associated with exacerbations and a discharge of pus. When the sacral nerves are involved, the pain is more constant and most severe. We also often see in advanced stages rectovaginal or vesicovaginal fistulas, making a distressing disease complex. Advanced disease causes a characteristic waxy anemia. Loss of flesh and extreme lassitude mark the later phases.

Diagnosis.—Here as elsewhere, in cancer, a stitch in time saves nine, the nine standing for lives saved. I have for a generation past insisted that every woman who has been through childbirth ought to have yearly or half-yearly

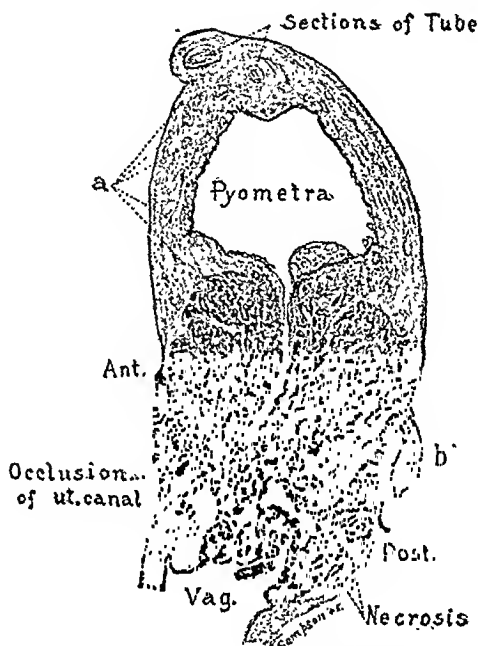


FIG. 487.—SQUAMOUS CARCINOMA OF CERVICAL CANAL: PROBABLY EVERTING FORM; PYOMETRA.

Sagittal section of uterus slightly reduced. Growth occludes cervical canal, causing pyometra: *a*, threadlike extensions of growth through body of uterus; *b*, epiploic appendage of sigmoid adherent posteriorly and invaded by growth.

examinations to detect early disease and any early changes in the cervix. If the cervix is lacerated, infiltrated, and everted, the condition should be destroyed by thorough cauterization, and the patient watched at intervals of four to six months for a couple of years. If this régime were carried out generally, thousands of lives would be saved. Also, every irregular discharge should be traced to its source.

It is impossible to diagnose cancer of the cervix from the subjective symptoms. Uterine bleeding is nearly always present at some time and is usually

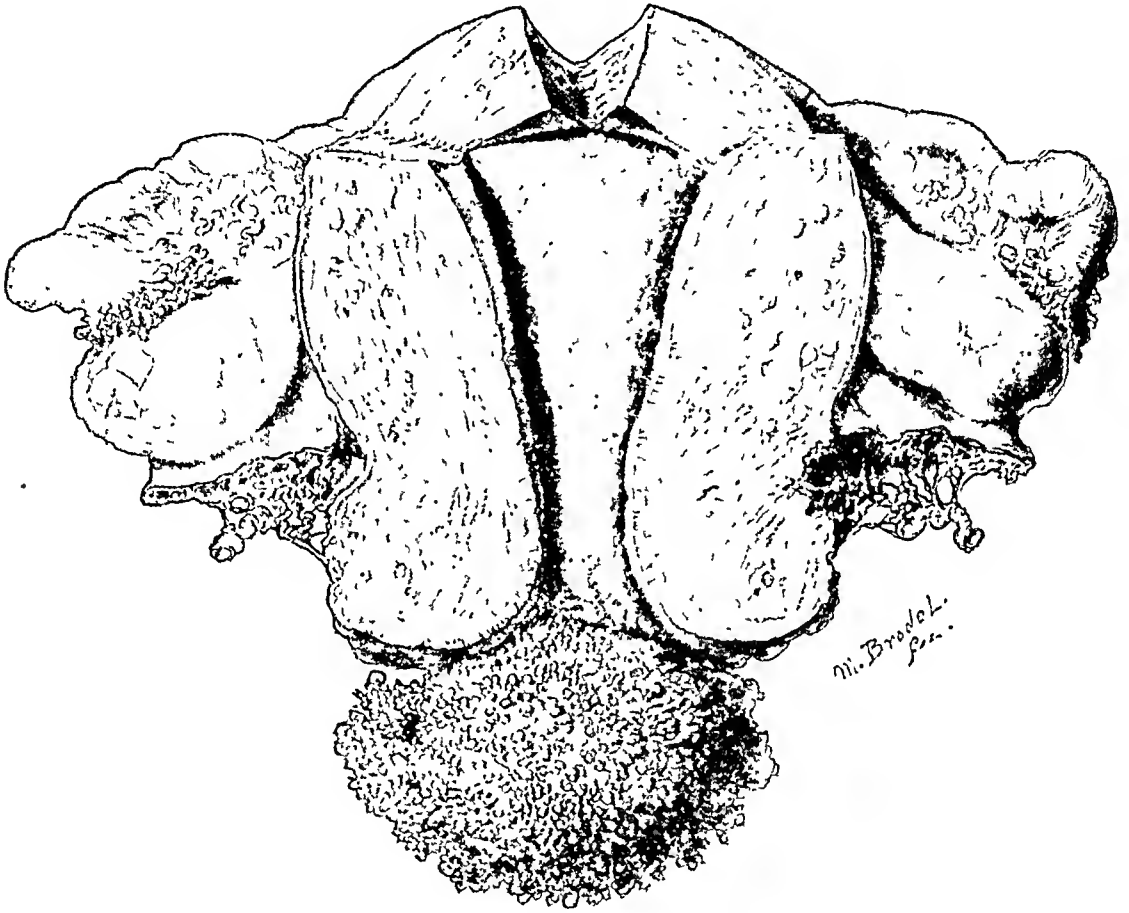


FIG. 488.—SQUAMOUS CAULIFLOWER CARCINOMA OF CERVIX FROM ANTERIOR VIEW.

Mass somewhat pedunculate, well illustrating vegetative type. Uterus opened posteriorly. (T. S. Cullen.) $\times \frac{4}{5}$.

the earliest manifestation of disease. For this reason, every uterine bleeding should be immediately investigated and its source and cause determined. Even at an early date, a positive diagnosis can often be made by touch and inspection when the trouble springs from the vaginal portion. The friable, fungoid mass with its papillary projections which bleed so readily can hardly be mistaken, Figures 488 and 489.

In the inverting type, Figure 490, the indurated nodule can usually be diagnosed by the associated ulceration, so frequently present, and by bleeding on touch. The growths hidden within the cervix are more difficult to recog-

nize early. The hard mass at the vault, congested and bluish in color with a ragged edge bleeding if touched inside with curet or sound is characteristic. Figure 491 is a reconstruction showing the relation between the cancer and the specimen shown in Figure 492, where there is apparently a dual focus.

It is important to settle so far as possible the question of the extension of the disease; to this end the vagina is examined by touch and inspection for any evidence of nodules on or beneath its surface. A cystoscopic examination should be made for any vesical involvement. A careful bimanual examination determines any limitation of the mobility of the uterus and any thickening in the adjacent broad ligament. A rectal examination should never be omitted as by this avenue is secured the best idea of lateral and posterior extensions, often not otherwise discoverable. It is obvious that a soft yielding parametrium does not necessarily exclude a cancerous extension, but, on the other hand, an indurated parametrium does not neces-

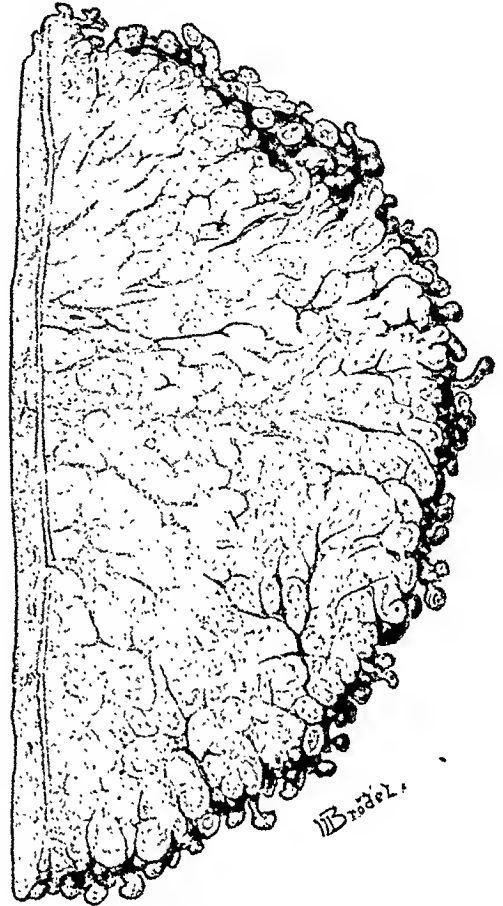


FIG. 489.—SECTION OF CAULIFLOWER MASS, SEEN IN FIGURE 488.

Showing vegetative papillary structure of everting type. (T. S. Cullen.)
× 3.

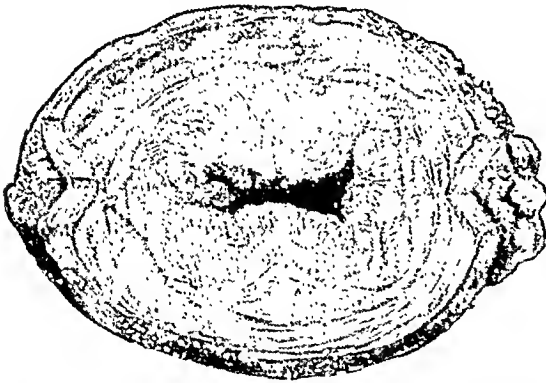


FIG. 490.—CERVIX OF SPECIMEN SHOWN IN FIGURE 474.

Vaginal portion of cervix nearly intact, retracted, and thrown into folds by sloughing of growth within. × 1.

sarily indicate infiltration with the disease. It is well always to make a sketch of the findings as even a rough sketch is a valuable record.

Always when accessible, a piece of the apparent disease should be clipped off and put into a 5 per cent formalin solution for immediate microscopic examination, Figure 493.

If the disease is inside the canal, it should be curetted gently for tissue. By using an acusector (endotherm) loop, a piece is removed readily at any point which can be seen. If the tissue bleeds, a pack will control it. Where the corpus uteri is involved, the curettage can usually be done without anesthesia; however, for a more searching examin-

ation a complete anesthesia is desirable. A pocket lens magnifying ten times gives a decisive picture.

A variety of conditions simulate cervical cancer:

1. Lacerations causing a flaring of the cervical lips and a consequent eversion of the cervical mucosa into the lumen of the vagina, or the presence of cervical mucosa extending over the vaginal portion, may be mistaken for the "everting" or vegetative type of growth, especially in the presence of any inflammatory induration.

2. Nodules situated beneath the mucosa of the vaginal portion or within the cervical wall are caused by distended cervical glands or a small myoma simulating the nodular type.

3. Ulcers, *i.e.*, true erosions of any portion of the cervix, may closely resemble a cancerous ulceration.

4. Polyps or submucous myomata protruding into the cervical canal, or even from the external os into the vagina, may be mistaken for malignancy.

5. Syphilitic and tuberculous lesions of the cervix are often puzzling.

In the later stages of cancer of the cervix, when the disease forms either a large fungoid friable mass or a craterous cavity, the diagnosis is only too easily made.

A microscopic examination of tissue will correct all errors. In none of the affections named is the tissue ever so

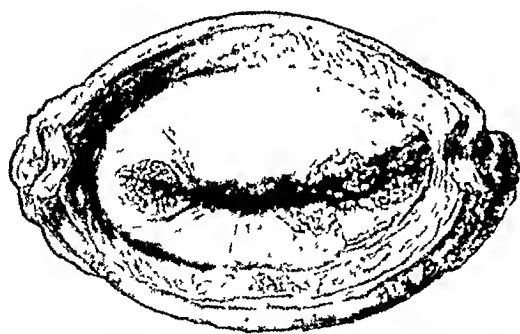


FIG. 492.—SQUAMOUS CARCINOMA OF VAGINAL PORTION OF CERVIX: INVERTING FORM; MEDULLARY WITH NECROSIS.

Growth apparently starting simultaneously in both corners of external os. $\times 1$.

friable that a little block can be removed readily by a curet, and all are well localized.

In pregnancy, rare in cancer of the cervix, the disease advances with the utmost rapidity, and if possible an early extirpation should be done unless the pregnancy is near its end when cesarean section and complete extirpation offer the best hope.

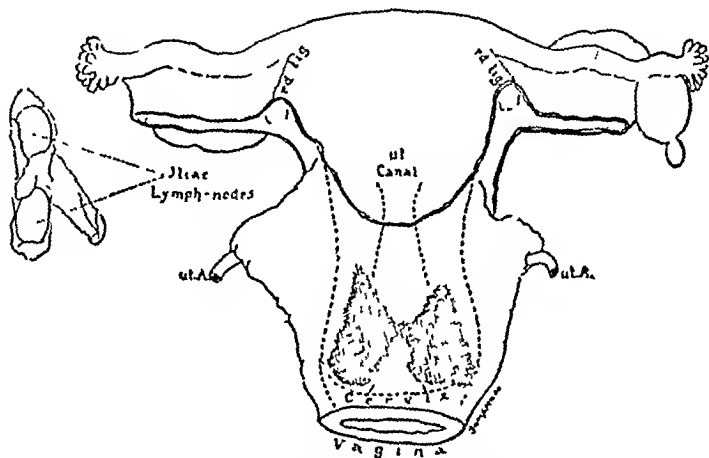


FIG. 491.—APPROXIMATE RECONSTRUCTION SHOWING RELATION BETWEEN CANCER AND SPECIMEN REMOVED AT OPERATION IN FIGURE 492. $\times \frac{1}{2}$.

Cancer apparently has dual focus and has invaded cervical tissues lateral and posterior to cervical canal. $\times \frac{1}{2}$.

Treatment.—Treatment in cancer of the cervix is still a moot subject. There are two aggressive plans from which to choose or to combine; namely, radium and surgery.

The first question the patient is apt to ask is, "Is it curable?" The answer depends primarily upon the extent of the disease. If the broad or the uterosacral ligaments are involved (rectal examination), and *a fortiori* if there is a conical extension with its base out on the pelvic wall or if the uterus is fixed, no radical operation can be done with a justifiable hope of any real benefit commensurate with the risks incurred and the disabilities likely to ensue.

Therefore, an operable case is defined as one in which the risks of the operation *per se* are made minimal by an apparent absence of all disease outside the freely movable uterus. One must here be careful not to confuse such fixation as may arise from a coincident pelvic inflammatory disease with an extension of the cancer in the cervical plane. He who, neglecting a thorough pre-

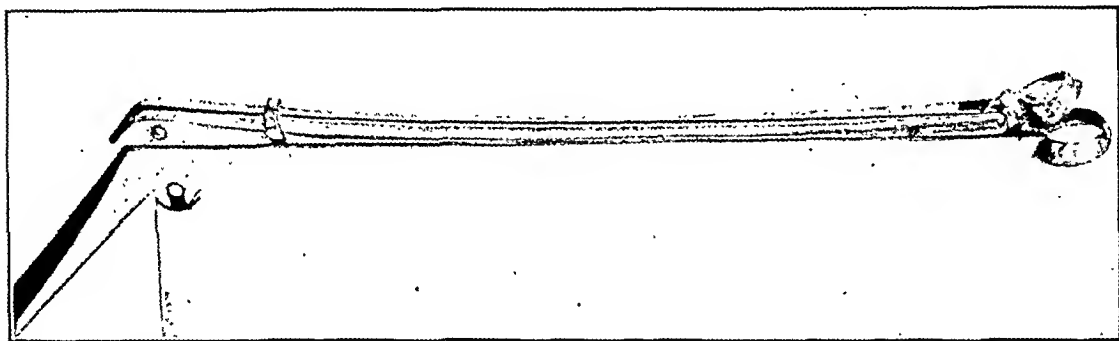


FIG. 493.—SHARP-CUTTING CLIP FORCEPS FOR REMOVING BITS OF TISSUE FOR MICROSCOPIC EXAMINATION AND FOR CUTTING DOWN SCLEROSED INFLAMMATORY TISSUES.

liminary examination, proceeds to operate, will often open the abdomen to discover that his only recourse is gracefully to close his incision with an apology. By operating only on carefully selected cases, the immediate mortality should be small and the percentage of complete recoveries extended over a prolonged period.

On account of the numerous distressing recurrences even in this hopeful group, there is a growing inclination invariably to decline operation in favor of radium. Radium usually clears up permanently all early cases and a number of those with some moderate lateral infiltration and occasionally one of the advanced inoperable group. All radium cases need watching at intervals for some years on account of their liability to a recurrence. A great advantage of radium lies in the prolonged period of improvement following treatment. It brings a promise of solace not only to the curable but to the incurables as well.

An alternative is to radiate and to operate within a few days. When patients cannot be followed up carefully after radiation, this plan is my preference (Chapter XLIV).

After a prolonged experience and attempts to widen the field of the extirpation, as for example in a radical removal of the pelvic lymph-nodes with the uterus and as much of the broad ligaments as possible, basing the operation

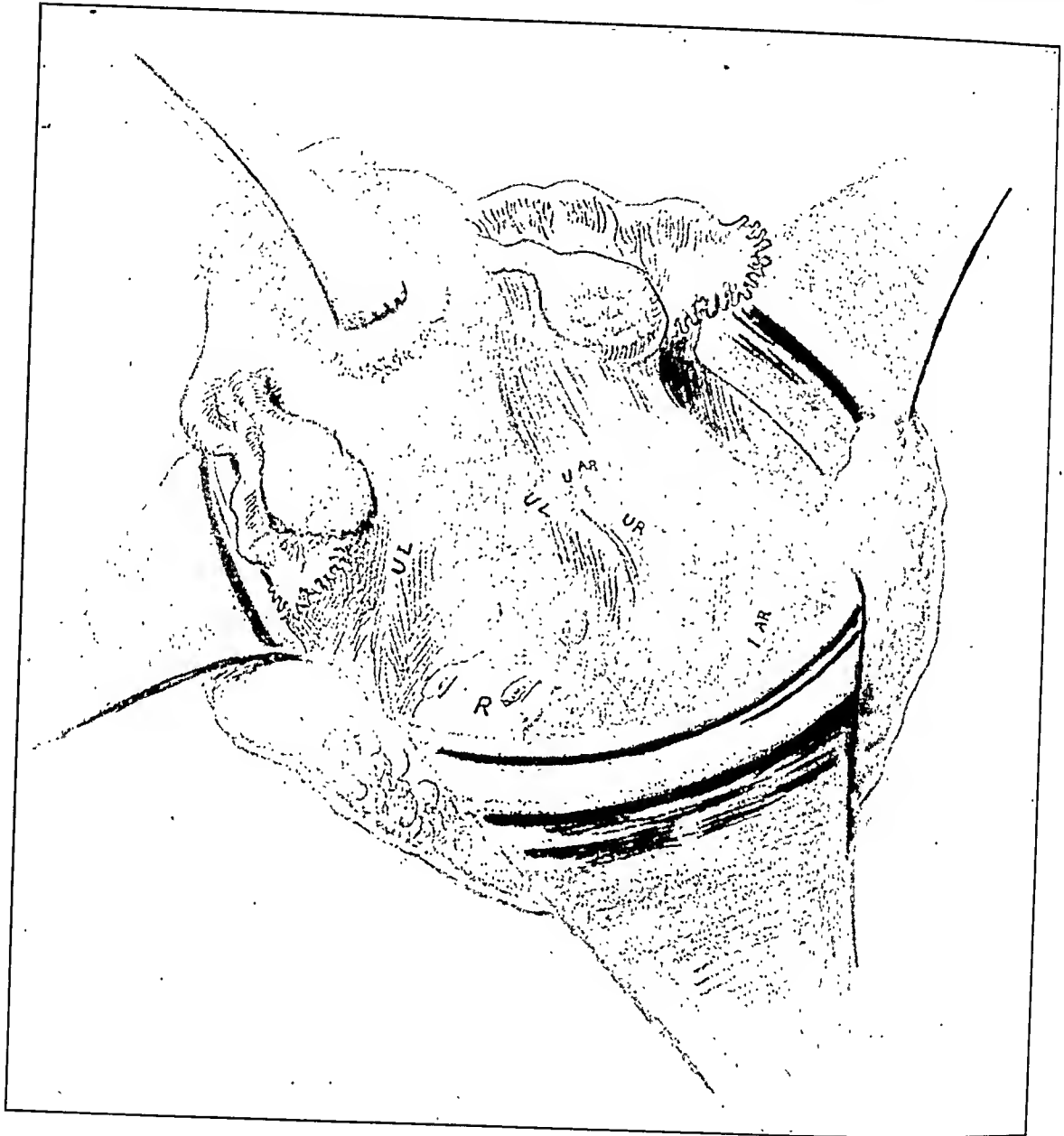


FIG. 494.—RETRACTION OF ABDOMINAL WALL.

Uterus, protected by gauze pad, grasped with museum forceps and pulled forward and somewhat to left, exposing pelvic floor and uterosacral ligaments (*UL*) and, on the right, the ureter (*UR*) as it drops over the iliac artery (*IAR*) to the floor of the pelvis and passes forward under the right uterine artery (*UAR*). (Rectum = *R*.) (Adapted from Döderlein and Krönig.)

on the analogy of the breast and axillary glands, the procedure of Wertheim has been adopted by general consent as the *via media* safer for the patient and affording the utmost practical security against a recurrence.

Preliminary to the operation, the vagina should be cleared of all accessible

necrotic fetid tissue by a thorough curettage or better by coagulation with an endotherm current. This is done just before operation and a loose gauze pack is left in the vagina to catch any discharge or débris; the end is left hanging out for withdrawal when the vagina is opened from above.



FIG. 495.—FIRST STEP IN ABDOMINAL OPERATION.

Infundibulopelvic ligament grasped near ovary by pair of forceps and pulled up and out and posterior fold of broad ligament split open well above ureter. Infundibulopelvic ligament is then ligated and incision through peritoneum continued anterior to uterine appendages, after which round ligament is ligated and cut.

After opening the abdomen and elevating the pelvis and freeing it of all encumbering viscera, Figure 494, the extirpation proceeds by the following steps:

1. The tops of both broad ligaments are ligated (it is not always necessary to remove the ovaries), and the incision begun which is to lead down to the base of the ligament.
2. Both round ligaments are tied and cut.

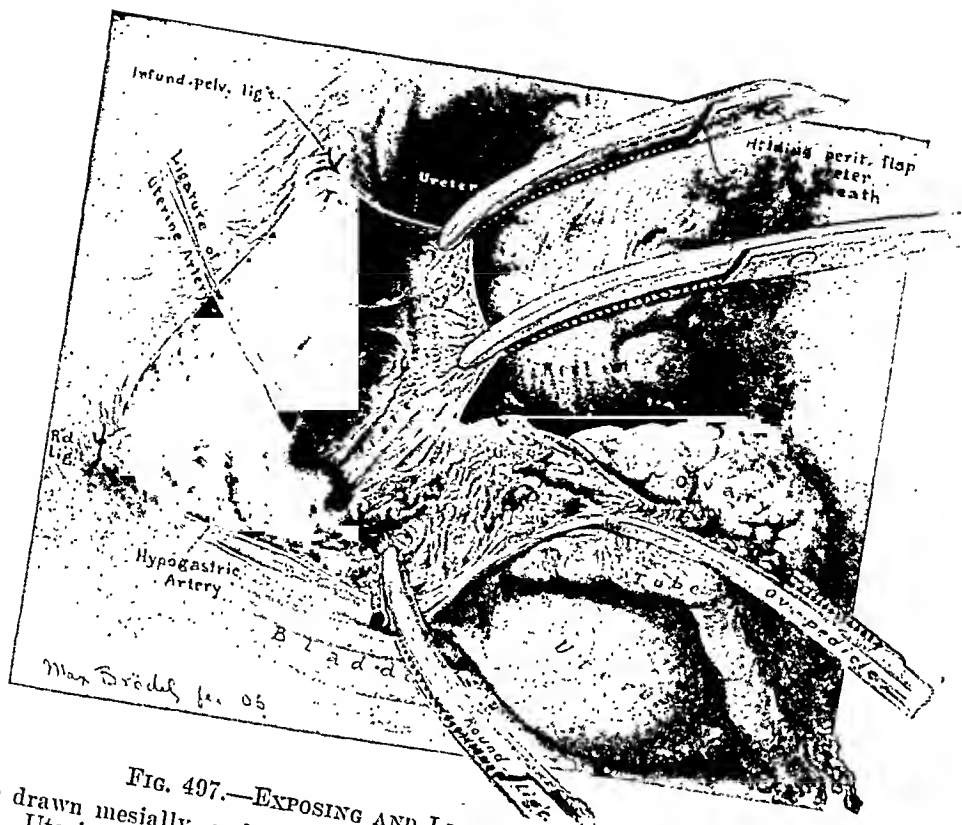


FIG. 497.—EXPOSING AND LIGATING UTERINE ARTERY.

Uterus drawn mesially, and with it lower peritoneal flap to which ureter is adherent in its sheath. Uterine artery ligated beyond ureter near its origin.

Wm. B. B. B.

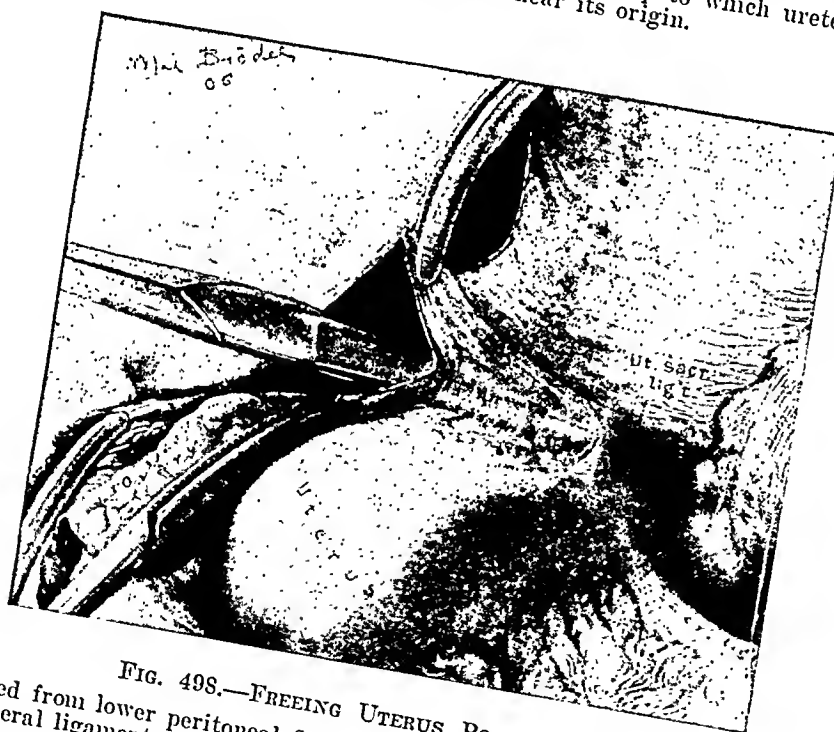


FIG. 498.—FREEING UTERUS POSTERIORLY.

Ureter pushed from lower peritoneal flap just above parametrium and peritoneum incised down to uterosacral ligaments, in dotted line.

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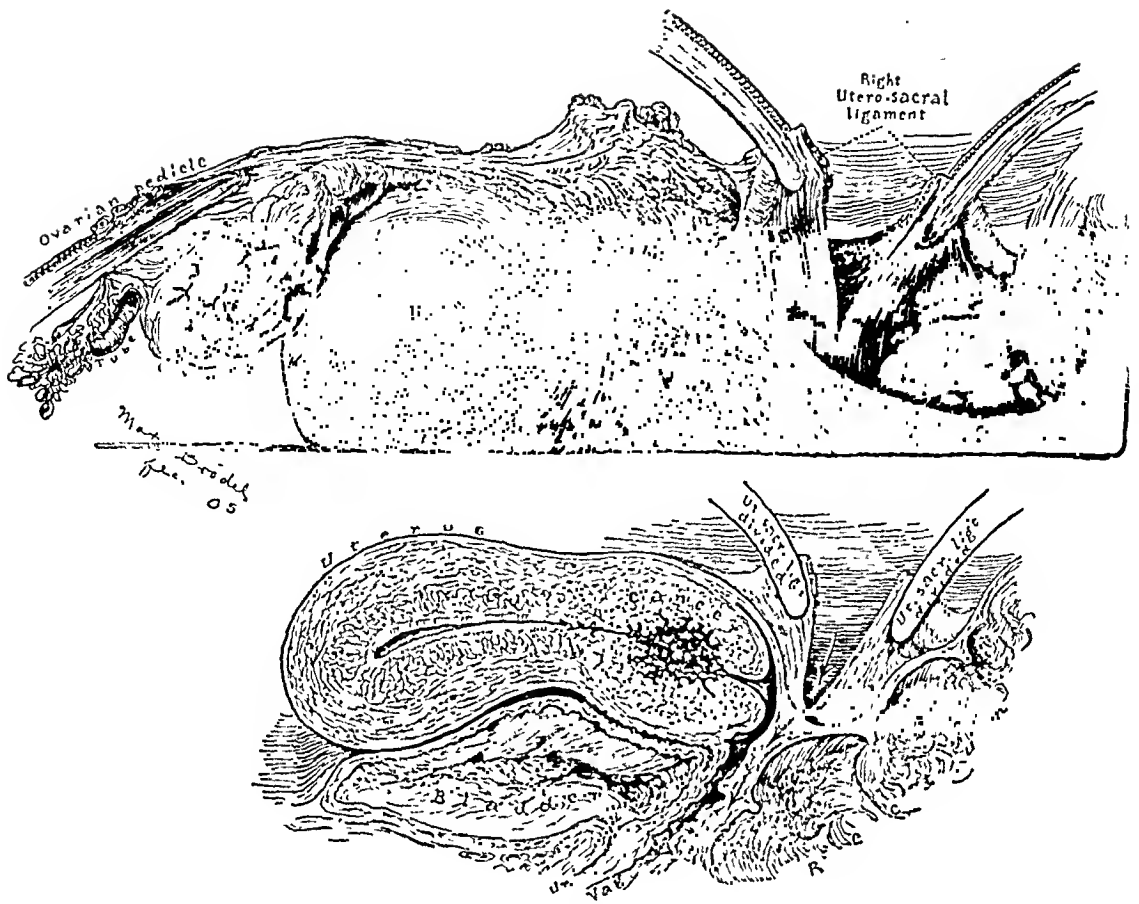


FIG. 499.—UTEROSACRAL LIGAMENTS CUT, AND UTERUS AND VAGINA FREED POSTERIORLY.
Arrows in lower figure show direction of dissection.



FIG. 500.—WIDE EXCISION OF PARAMETRIUM.

Ureter drawn laterally and wide excision accomplished with control of venous plexuses by ligating this tissue well out toward pelvic wall. Ureter, above parametrium, remains adherent to peritoneal flap.

with the uterine artery ligated. When this procedure is repeated on the opposite side, the uterus with its cervix then remains attached only by the upper part of the vagina. Yet another way of reaching the ureter is to ligate the broad ligament from top to bottom, step by step, keeping well away from the uterus until the uterine artery is reached. This is then tied and the ureter sought just below it. This plan is not so easy as the other. Observe two things with care: Do not dissect the ureter free at any point from the attached underlying tissues but displace it laterally still attached and then tie off the vascular area on both sides of the vaginal vault with the ureter in plain sight.

6. The vaginal pack is now withdrawn by an assistant, and, after packing the pelvis on all sides and protecting the abdominal incision with gauze sandwiched with rubber tissue to prevent contamination, the vaginal vault is opened in front. Any blood and débris found in the vagina may be cautiously sponged out with cotton pledgets. At this point the anterior vesical peritoneum should be sutured to the anterior vaginal wall at its middle point.

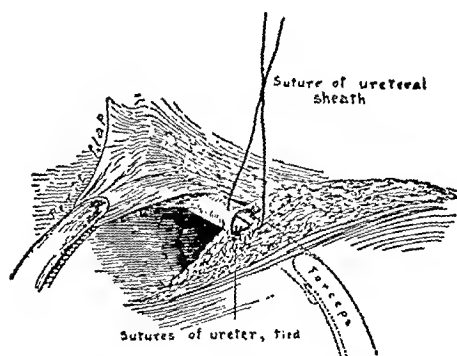


FIG. 502.—URETEROVESICAL IMPLANTATION: SUTURING URETER AND SHEATH (WHEN WELL FORMED) TO BLADDER WALL.

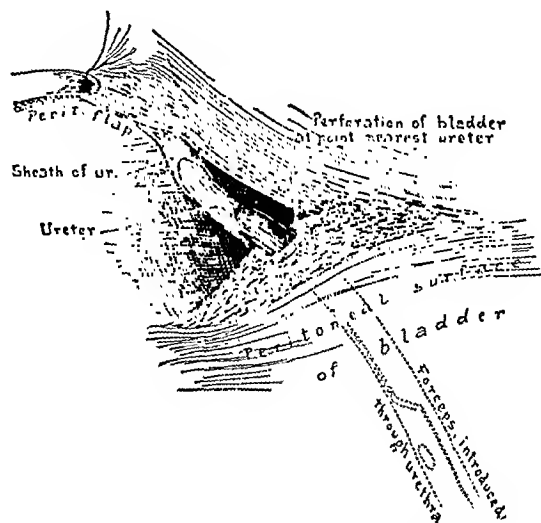


FIG. 501.—URETEROVESICAL IMPLANTATION: DRAWING URETER INTO BLADDER.

Peritoneal flap containing ureter drawn down to bladder. Lower end of ureter, bared of its sheath, drawn through opening in bladder.

7. The incision is continued around the vagina which is caught and held in from four to six places with a Kocher-Ochsner forceps and the whole surrounding field studied with care and all hemorrhage checked by passing fine catgut sutures.

8. The anterior layer of peritoneum is drawn over on each side and attached to the posterior so as to cover the ureters well.

9. The vagina can then be wiped out below and a liberal cigarette drain inserted from above. The operator then steps out and the assistant closes the abdomen after laying aside all contaminated instruments and changing his gloves.

The most sedulous care must be exercised in the last steps to avoid all contamination of the abdominal incision.

A postoperative cystitis is due to the laming of the bladder and retention of urine with imperfect evacuation and not as a rule to catheterization as commonly imagined. The urine should be examined daily after operation, and if any pus or débris are found the bladder should be catheterized after several evacuations to determine the fact and the degree of the retention. Any retention should be relieved by catheterization at intervals and irrigations

with a 2 per cent carbolic solution. After washing out, a solution of silver, about 1:1,000 or 1:1,500, should be injected and held in the bladder for ten or fifteen minutes. If the cystitis is distressing and severe, the patient will do better on a continuous irrigation for one to two hours daily until the urine clears up. With such care a protracted cystitis is rare.

Life can sometimes be prolonged in inoperable cases by exposing the ureters, dividing, and implanting them in the loin. I had a case some years ago with anuria due to the blocking of both ureters by massive lateral extensions of cervical cancer. The patient was everywhere hydremic and edematous, and

her face puffy almost beyond recognition. I made a permanent catheterization of the ureters, and there was an immediate continuous flow of urine of high specific gravity, amounting to many quarts daily. This resulted in a marked improvement lasting for a month, during which time she saw her family and adjusted her affairs.

BODY

Adenocarcinoma of the fundus of the uterus is rarer than cervical carcinoma, grows more slowly, and remains restricted to its site in the uterus for years.

Incidence.—Cancer of the body is rather an affection of a later period of life. More than 35 per cent were over fifty as compared with less than 35 per cent in cervical cancer.

Previous pregnancies play a less important rôle here.

Myomata are associated more frequently with this form than with cervical cancer. We have no preventive measures as in the cervix.

Extension.—The relatively high percentage of permanent cures following operative treatment even of old cases demonstrates that the growth is usually restricted to the uterus for a long time. As it progresses, the neoplasm may push its way through the uterine wall, appear under the peritoneum, and then invade any contiguous adjacent structure; again, it extends between the folds

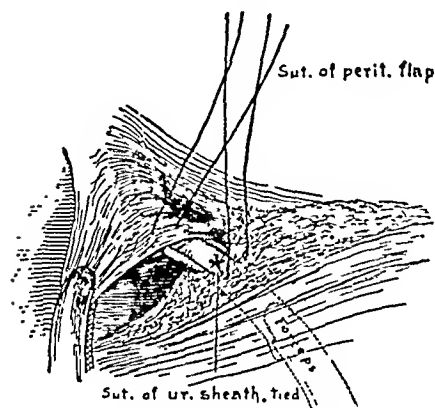
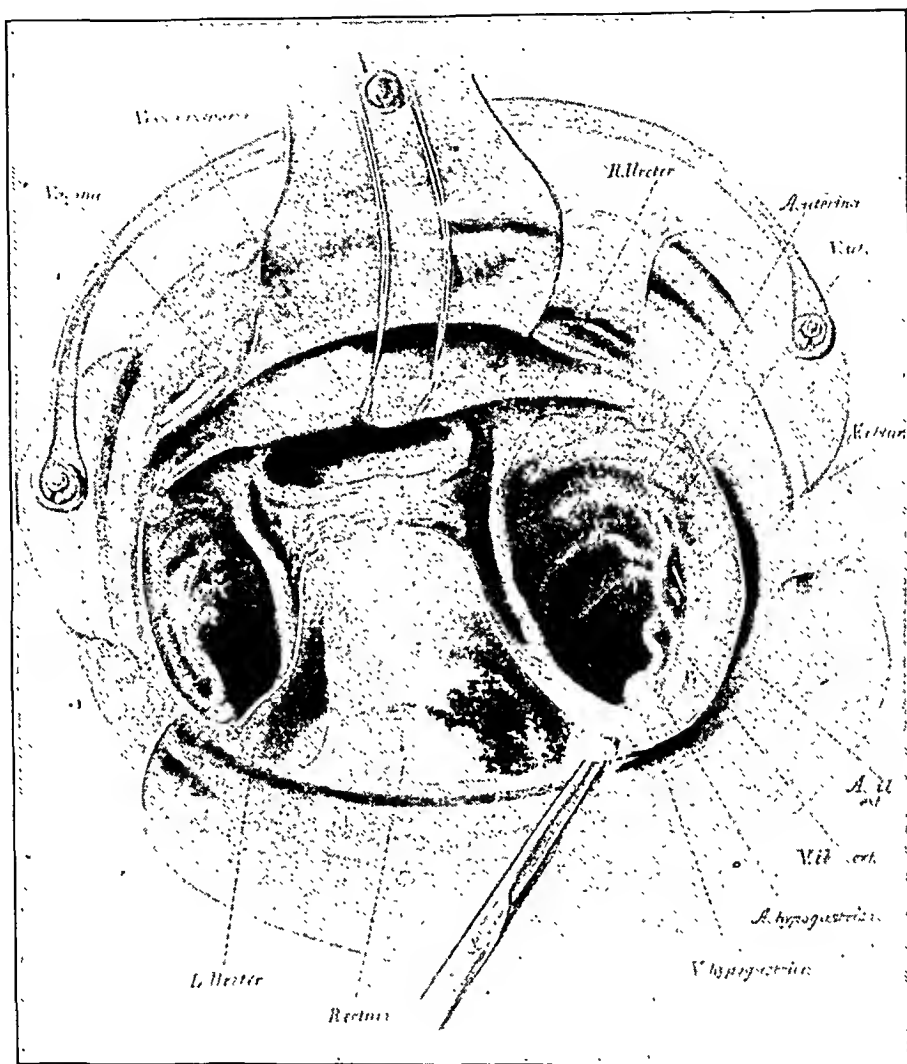


FIG. 503.—URETEROVESICAL IMPLANTATION.

Ureter and sheath sutured to bladder wall; peritoneal flap under which ureter lies also sutured to bladder wall and to peritoneum covering bladder.

Duration.—About 67 per cent of my operable cases of cancer of the fundus had been bleeding for over a year as compared with only about 21 per cent



Ureters in enucleating should be displaced carefully outward to pelvic wall and left as nearly as possible in their entirety attached to adjacent tissues and wall (Döderlein and Krönig).

of the operable cervical cancers. In ten of fifty-six operable cases of fundal cancer there was a history of bleeding for over five years, but in two of these it may have been due to a large submucous myoma; in one, however, it was of sixteen years' duration, and the cancer alone could account for it. On the other hand, in but three of 162 operable cervical cases was there a clear history of hemorrhage for as much as three years.

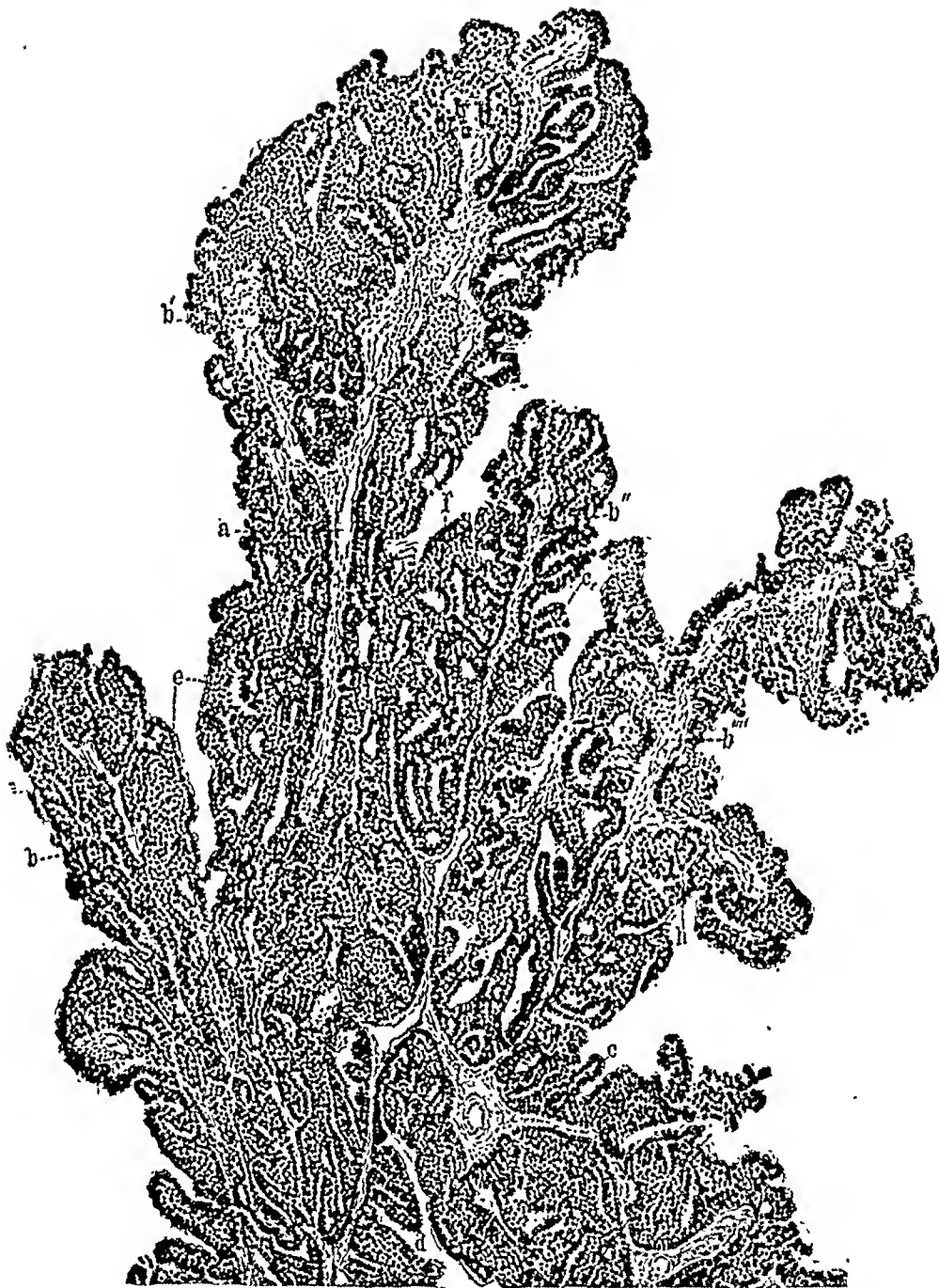


FIG. 505.—DELICATE BRANCHING OUTGROWTHS COMMON IN ADENOCARCINOMA OF BODY OF UTERUS.

Note delicate dendritic arrangement. Growth consists of main stem or trunk (*a*) sending off branches, *b*, *b'*, *b''*, *b'''*. Stem and branches consist of spindle-shaped connective-tissue cells, hardly stout enough to carry blood supply. Covering main trunk and all branches, many layers of epithelium; layer of cells next to stroma arranged at right angles. From branches epithelium projecting as delicate tufts (*c*) or forming more stable masses (*d*). Occasionally (*e*) surface smooth and covered by one layer of low cylindrical epithelium. Throughout field epithelial cells tend to form definite glands, particularly shown at *f*. In older portions, epithelium forms solid masses as at *g*. Nuclei of cells remarkably uniform in size and staining properties. (T. S. Cullen.) $\times 75$.

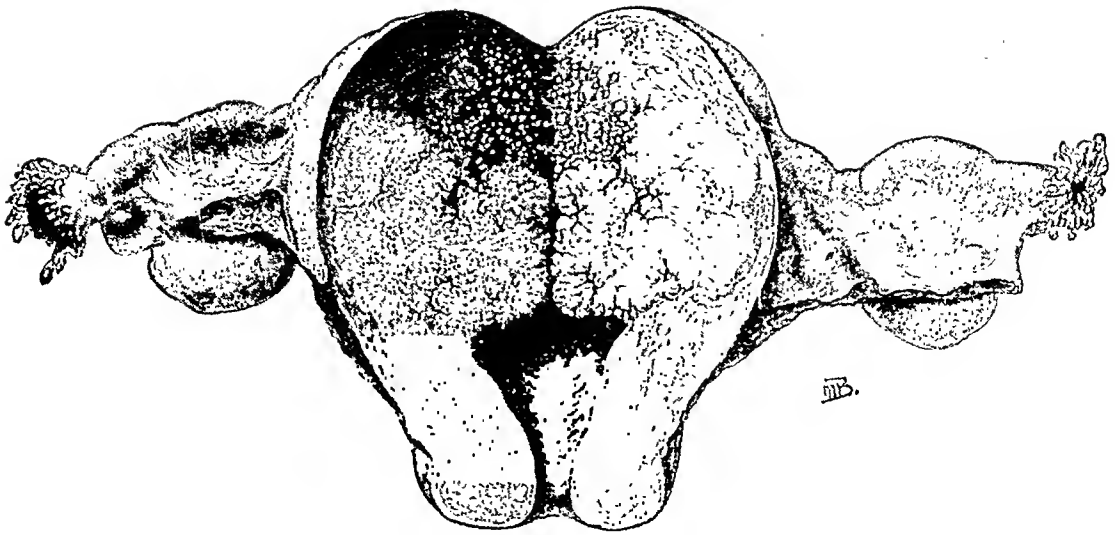


FIG. 506.—ADENOCARCINOMA OF UTERINE BODY, WITH METASTATIC NODULES IN LYMPH CHANNELS OF LEFT BROAD LIGAMENT AND NODULE IN LEFT ROUND LIGAMENT.

Almost entire body converted into carcinomatous mass; cervical portion free. Large gland, about 2 centimeters in diameter, removed from pelvic wall showed only hypertrophy. (W. W. Russell.)

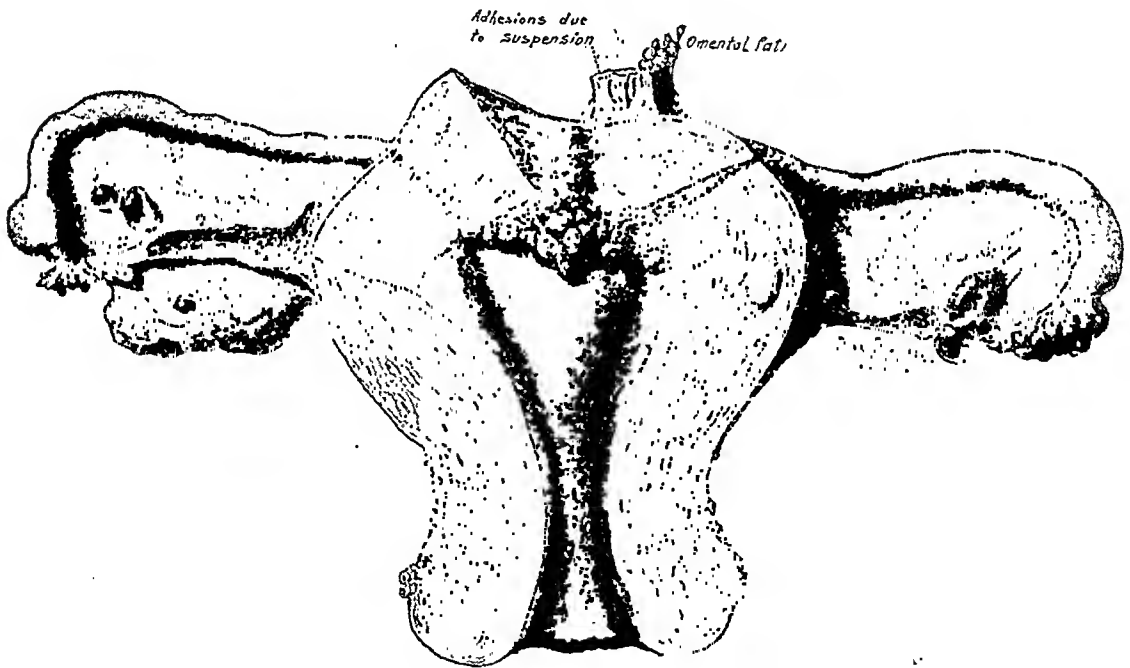


FIG. 507.—EARLY ADENOCARCINOMA OF BODY OF UTERUS.

Uterus normal in size and shape. Attached to fundus are broad adhesions due to previous suspension. Uterine walls of usual thickness contain two small myomatous nodules. Mucosa of greater portion of cavity and of cervix is normal. Springing, however, from fundus is finely lobulated growth, not appearing to penetrate uterine walls. This uterus examined during operation for removal of ovary seventeen months before. We know from microscopic examination that carcinoma existed more than seven months before final operation, demonstrating slowness of growth. (T. S. Cullen.) $\times \frac{2}{3}$.

Cause of Death.—As in the cervical form, the patient becomes cachectic from the repeated hemorrhages and the absorption of toxins, and a terminal infection frequently intervenes. The cause of death sometimes depends upon the parts invaded by the disease.



FIG. 508.—ADENOCARCINOMA OF BODY OF UTERUS. SCRAPING FROM UTERUS REPRESENTED IN FIGURE 507.

Note gland grouping, characteristic of carcinoma. Four distinct groups indicated by *a*, *b*, *c*, and *d*. Epithelium in places only one layer deep; as a rule, many layers present. *e*, solid epithelial cells, traceable far to right and left. On the whole, nuclei in this section are uniform in size and vesicular, but at *f* is a slightly enlarged and deeply-staining nucleus, and at *g* others much larger, staining deeply. In group *b*, above and to left, lying against stroma is very long and deeply staining nucleus. *g*, large cell with nucleus divided irregularly. Polymorphonuclear leukocytes (*h*). *i*, stroma, rather scanty and dense. *k*, blood capillaries. Gland arrangement alone certifies diagnosis of adenocarcinoma, supported by proliferation of epithelium and occasional enlarged deeply staining nuclei. (T. S. Cullen.) $\times 120$.

Symptomatology.—So long as the disease remains *in utero*, but two symptoms are likely to arise: a leukorrheal or watery discharge and hemorrhage. With an extension beyond the uterus, symptoms vary with the parts involved.

Diagnosis.—A history of a watery or a blood-tinged discharge or bleeding, especially if the patient is near to, or past the menopause, with a uterus

somewhat enlarged, should suggest cancer of the body of the uterus. The diagnosis is only made certain by examining the mucosa microscopically. Sometimes a vaginal implantation may be the first indication or a nodular elevation on the floor of the pelvis palpable bimanually. If allowed to go on, the uterine mass may attain the size and form of a myomatous uterus, loosely filling the pelvis, or say of a four months' pregnancy. Cachexia and the irregu-



FIG. 509.—TYPICAL PROLIFERATION OF GLAND EPITHELIOMA WITH FORMATION OF NEW GLANDS IN ADENOCARCINOMA OF BODY.

At *a* gland epithelium practically normal; at *b* marked cell proliferation, one cell containing two large deeply staining nuclei. Increase of cells at *c* marked. Nuclei larger in size, notably at *d*. Gland formation seen at *e*. In numerous places polymorphonuclear leukocytes have wandered out between cells as indicated at *f*. *g*, stroma unaltered. Marked epithelial proliferation with new gland formation and deeply stained nuclei (*b* and *d*) leave no doubt as to malignant character. (T. S. Cullen.) $\times 185$.

larity of the hemorrhages ought to put one on one's guard. The curet at once removes all doubt.

Treatment.—The curability is three or four times that of cervical cancer.

Two methods are available: A radical operation (panhysterectomy), as a rule including both tubes and ovaries, and radium.

The radical procedure is always preferable where there is no well-defined contra-indication, the reason being twofold—chiefly that the operation itself is so safe and the end results so satisfactory, and further because radium cannot be satisfactorily applied over a more or less extensive, indefinite, invisible (in the dark as it were) area to so resistant a disease.

Where the radical operation is inadvisable either because of the extent of the disease or by reason of extreme ill health or frailty or some other existing serious complication or of the occasional positive refusal to submit to an operation, radium then becomes a precious boon, almost always securing a marked improvement and stopping hemorrhages and checking a foul dis-

charge. In a number of instances it has also resulted in an apparent cure, extending over several years, as I have verified by curettage. The amount of radium advisable depends upon the size of the uterus, the depth of its cavity, and the probable extent of the disease and so varies from 1,500 to 3,000 mc. hours. If the uterus is deep and large, it must be considered as divided into and treated in segments, introducing the radium up to the fundus and withdrawing it in stages until the entire interior is thoroughly radiated. The next application follows in three or four months, when the patient returns for a curettage and examination and possibly more radiation.

The steps in a panhysterectomy are as follows:

1. A thorough cleansing of the vagina and often a closure of the cervix with two mattress-sutures. A loose gauze pack is left in the vagina to be withdrawn when the vagina is opened from above.

2. The abdomen is opened, the table elevated, and the uterus, usually enlarged, grasped and drawn to the right while the left ovarian vessels are tied off at the pelvic brim, followed by ligation of the round ligament at 2 centimeters from the uterus.

3. The top of the broad ligament is opened and pushed down a little from the uterus and the bladder dissected loose from round ligament to round ligament and detached down to the vaginal vault.

4. The left uterine vessels are then exposed and tied low down in the cervical region while the uterus is drawn strongly upward and to the right. The slower Wertheim operation involving the exposure of the ureters is not called for as the extension of the disease is not via bases of the broad ligaments.

5. After dividing the uterine vessels on the left side, they are pushed down gradually with the tissues embracing the cervix in front and behind.

6. As the uterosacral ligament is brought into prominence, it is ligated at a point about 1.5 centimeters from the uterus.

7. The next step involves the ligation and detachment of the structures on the right side as on the left. With the uterus freed on all sides, the operator with thumb and forefinger ascertains the position of the cervix, and

8. Proceeds to open the vagina anteriorly. The vaginal pack is withdrawn; if there is no soiling of the vagina the risk of infection is lessened.

From this point on, great care must be taken to avoid all contamination from the vagina and the cervical end of the uterus as it is removed. This care is especially directed toward not soiling any part of the abdominal incision. If not already protected, it is well now to cover the entire incision on all sides with impermeable gauze and thin rubber pads.

9. The uterus, its cervix now severed and removed and the vagina caught with forceps at four cardinal points to prevent its dropping back on to the pelvic floor, is removed.

10. The final step consists in attaching the bladder to the anterior vaginal

wall, controlling any small bleeding vessels especially at the right and left angles, fastening the round ligaments into the angles near the vagina to hold it up, and uniting the middle of the anterior to the middle of the posterior vaginal wall so as to leave two vaginal openings for a cigarette drain on each side. This is better than a single larger opening where the small intestine may slip through.

If the operator's hands have been contaminated during these latter manipulations, he ought either to change his gloves or quit the field and leave an assistant to close the abdominal incision. After the first incision into the vagina, every instrument used about the pelvic floor must be held as contaminated in a special dish apart from the rest, in which they are finally removed. Should the incision be unavoidably contaminated, the best plan is to wipe it off with alcohol and insert a couple of protective drains down in the subcutaneous fat. These precautions will often save much discomfort and an irksome delay of several weeks in convalescence.

SARCOMA¹

Sarcoma is a malignant mesoblastic tumor arising from the connective and muscular tissues of the wall, from the blood and lymph vessels, and from the endometrial stroma. The majority probably develop by metaplasia from pre-existing myomata.

The first record is that of Lebert in 1845, but our real knowledge began with Virchow's report of Mayer's case in 1860. J. Whitridge Williams first showed definitely that a sarcomatous transformation can occur in a uterine fibroid, Figure 510. His observations have been amply confirmed, but the question remains as to how common malignant degeneration is in myomata. Ashoff, Cullen, and more recently Masson, from the Mayo Clinic, report this change in about 1 per cent; according to others, the incidence is higher.



FIG. 510.—UTERINE MYOMA UNDERGOING SARCOMATOUS CHANGE.

Transition from normal muscle-fibers (*a*, *c*) into larger tumor cells (*b*, *d*, *g*). Cells containing two or more imbricated nuclei seen at *e* and *f*; clumps of large deeply stained nuclei at *h* and *i*. (Kelly-Cullen, *Myomata of Uterus*, W. B. Saunders Co.) $\times 200$.

¹ Prepared by Leo Brady.

Incidence.—Sarcoma is a rare growth and constitutes about 2 per cent of all uterine tumors or about 5 per cent of the malignant growths. Commonest in the young and in the middle-aged, it can occur at any age. These are also almost invariably the malignant tumors in infants and young children.

Classification.—Histologically, they are divided into round-, mixed-, and spindle-cell forms; practically it is convenient to group them by location, as of the cervix and of the body.

Cervix.—Cervical sarcoma is rare. Whereas most of the uterine carcinomata are cervical, the reverse is true of the sarcomata where but about one out

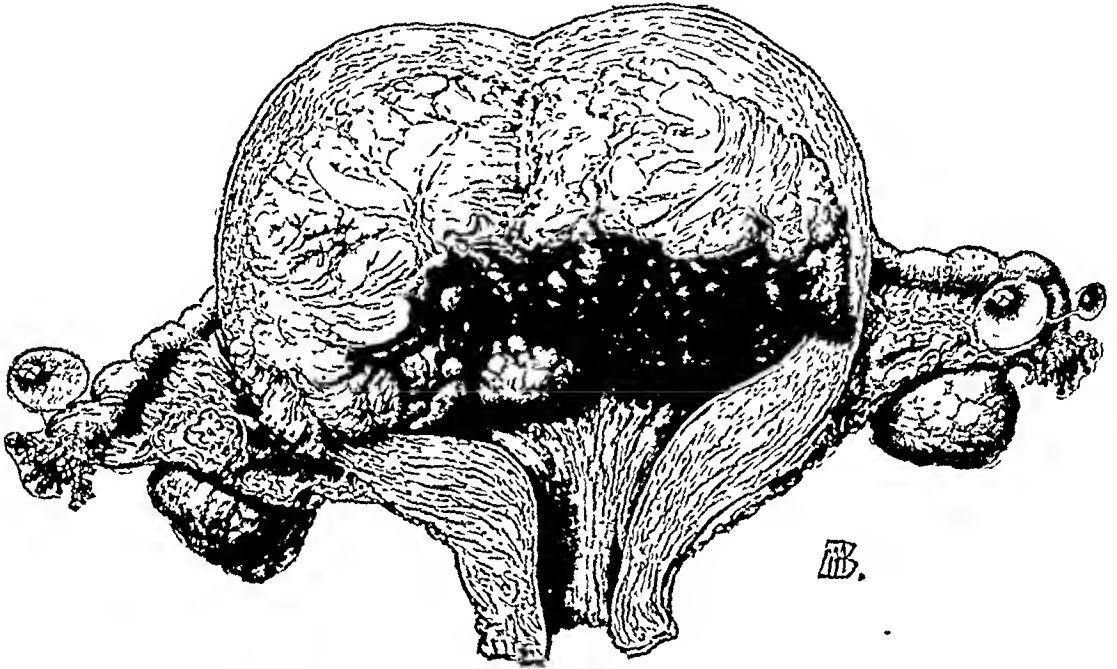


FIG. 511.—SARCOMA OF BODY OF UTERUS.

Upper two-thirds of uterine body distended with mulberry-shaped tumor masses like brain tissue; quite vascular. Line of junction with uterine wall sharply defined, but under microscope metastatic nodules found in lymphatics of left uterine cornu. Operation. No recurrence. $\times \frac{1}{2}$.

of five originates here. When first discovered, the lesion may form translucent round cysts, depending like a loose bunch of grapes (botryoidal) from the cervix, as originally described by Spiegelburg in 1879, and beginning in polypoid outgrowths from the mucosa, at first indistinguishable from simple mucous polypi. With growth, the upper vagina becomes filled by the mass and the vesicovaginal and rectovaginal septa are invaded. Instead of such a striking polypoid outgrowth, we occasionally see a diffuse infiltration of the mucous membrane. Sarcoma of the fibromuscular coat of the cervix has also been recorded, as a rule of the spindle-cell type.

Endothelioma of the cervix is an extremely rare condition, usually affecting the uterus. In one of my patients, the cervix was indurated and the external os represented by a craterlike excavation which proved to be a typical endothelioma.

Body.—Sarcoma of the body of the uterus commonly develops from a myoma but is also found in a uterus without any myoma when it originates either in the endometrium or in the parietal connective tissue and appears as a circumscribed tumor or a diffuse enlargement and softening of the entire uterus.



FIG. 512.—ENDOMETRIAL SARCOMA.

Endometrium normal everywhere except at left cornu where growth is attached. Tubes and ovaries normal.

The cells are either round or spindle-shaped, diffused throughout the entire thickness of the wall and distributed between what remains of the muscle-fibers. Endometrial sarcomata generally spring from the upper part of the cavity and, although usually diffuse, are at times sharply outlined, Figure 512. In a well-defined group, the endometrial sarcoma is associated with a complete or partial inversion of the uterus and should be considered in inversion of the nonpregnant uterus, Figure 513.

When found in a fibroid tumor, the earliest changes are only recognizable microscopically, but as the process advances, the sarcomatous areas reveal a fairly typical macroscopic picture in which the firm pinkish-white fibrous myomatous tissue is replaced by soft yellowish-white homogeneous tissue almost totally devoid of fibrous elements and resembling raw pork. Hemorrhages



FIG. 513.—LARGE ENDOMETRIAL SARCOMA PRODUCING PARTIAL INVERSION OF UTERUS.

The fundus of uterus inverted as a pouch drawing down with it proximal halves of fallopian tubes. Portions of fallopian tubes drawn into pouch are congested; otherwise normal.

occur in the sarcomatous areas giving the cut surface a reddish-brown mottled appearance in time replaced by the yellowish-brown color of the blood pigment. Usually the sarcoma is sharply defined from the myoma. The malignant degeneration starts in the center oftener than in the periphery of a myoma, Figure 514.

We know no more of the etiology than we do about cancer in general. Ewing considers that heterotopic myomata are more apt to become malignant than those in their usual site in the uterus and that we ought to be more

apprehensive of myomata in the broad ligaments and in other extra-uterine localities.

Sarcoma is always progressive to a fatal end. Continued hemorrhages cause extreme anemia and the general health rapidly breaks. With extension

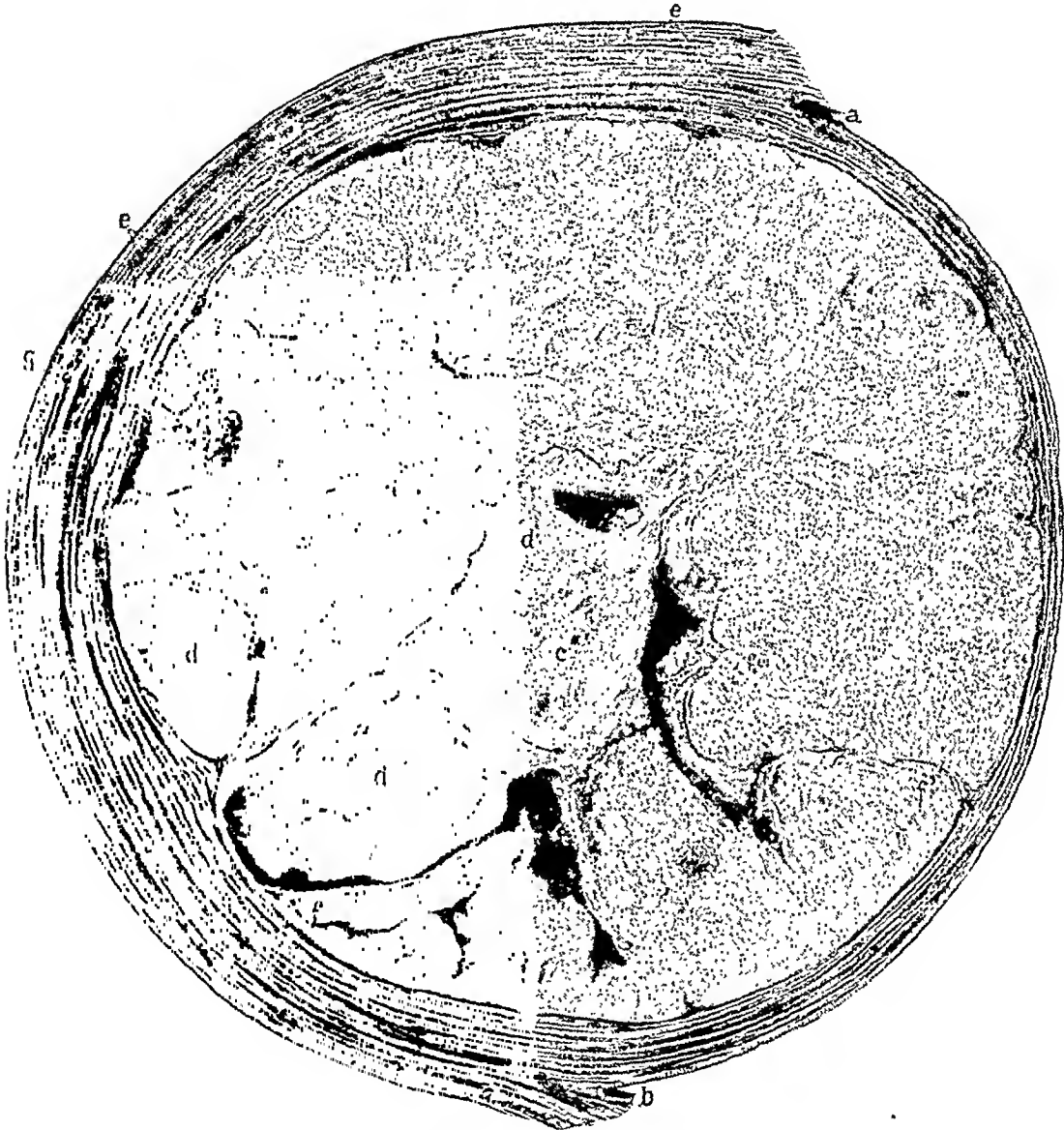


FIG. 514.—SARCOMA DEVELOPING INSIDE MYOMA.

Surface between *a* and *b* representing uterine cavity lined by thinned-out mucosa. Occupying wall of uterus is large myoma. *c* represents an area of hyaline degeneration, recognized by homogeneous and uniform consistence. Areas indicated by *d* are fine, porous masses of sarcomatous tissue, partly surrounding hyaline area *c*. Along outer surface of myoma, at *e*, other areas of sarcoma. Tissue between *f* and *f'* partly sarcoma, partly myoma. *g* is an area of calcification.

into bladder or rectum, fistulas develop adding to the extreme discomfort. Metastases develop later than in carcinoma and are prone to skip to the lungs.

Symptomatology.—Symptoms depend on the location of the tumor and its rapidity of growth. Malignancy in the center of a fibroid often causes no

symptoms at all and can only be determined at operation or after from the gross and the microscopic picture. With the rapidly growing tumor there ensues an early evident cachexia and often invasion of the neighboring organs. Endometrial sarcoma is marked by foul leukorrhea and profuse hemorrhages.



FIG. 515.—SARCOMA IN CERVICAL STUMP TWO YEARS AFTER HYSTERECTOMY FOR UTERINE MYOMA.

Springing from cervical stump is brainlike lobulated growth, anteriorly encroaching on bladder and posteriorly burrowing beneath rectum, and easily recognized by smooth homogeneous appearance. Left ovary is seen perfectly normal. For gross appearance see Figure 514.

A circumscribed parietal sarcoma may at first only be indicated by menorrhagia and an enlargement of the uterus, but on reaching the mucosa it has a foul vaginal discharge and metrorrhagia. Ascites appears with peritoneal involvement.

Diagnosis.—The differential diagnosis is generally microscopic, except where aided by age incidence, as in an infant or child, or by the phenomenon of rapid growth. Curettages done to relieve hemorrhage and discharge from time

to time reveal sarcoma of the endometrium or an extension from a myoma. It should also be suspected when a woman with a myomatous uterus develops ascites or a marked cachexia. A "myoma" suddenly increasing in size or softening is always suspicious. The development of hemorrhages after the menopause is suggestive, as well as the fact that supposed sloughing, pedunculate, submucous fibroids keep recurring. In one instance, on three separate occasions, sloughing, pedunculated fibroids were removed *per vaginam* but it was not until the fourth operation that the microscope showed that it was malignant.

Treatment.—Prompt extirpation of the whole uterus with the tubes and ovaries is the best method of treatment, unless metastases have occurred or the local extension is so definite as to preclude a total extirpation. Encouraging successes have been reported from deep x-ray and radium therapy, but it is as yet too early to estimate permanency. Persistent ray therapy is certainly indicated in inoperable cases as well as in some of the earlier ones in children, which are usually hopeless otherwise.

Because of this known possibility of metaplasia in myomata, some urge operation in all myomata, a view too radical when we recall that but 1 per cent of fibroids are found with sarcomata and that the mortality of the radical operation is at least that high. Furthermore, let us recall the fact that abstracting a group of a hundred of these sarcomatous myomata, a large percentage would proclaim themselves in various ways which would make obvious the advisability of operation, thus reducing the percentage of those likely to be overlooked by delay to perhaps a third or a fourth of 1 per cent. However, a thorough examination in the operating room of all fibroid uteri that are removed should always be made; every nodule should be opened and frozen sections made and examined microscopically from any areas which grossly suggest malignancy. If sarcoma is demonstrated, and a supravaginal hysterectomy has been performed, the cervix should then be dissected out to prevent a return of the growth in that area, a tragic event which has happened many times when this has been omitted, Figure 515.

CHORIO-EPITHELIOMA

Chorio-epithelioma, or *deciduoma malignum*, is a new growth developing during or after a normal pregnancy, an abortion, or the expulsion of a hydatiform mole, or (in some instances) before the mole has been expelled, and, rarely, after a tubal pregnancy. The disease first described by M. Sänger in 1889 has since then been kept constantly before the profession by the reports of numerous individual and collected cases. Sänger considered that the characteristic elements originated in the decidua; Marchand, in 1895, showed that the tumor took its origin from the syncytium, while the observations of Aschoff, Neumann, J. W. Williams, and others have since clearly established its genesis

in the chorionic epithelium, a demonstration following soon after the discovery that the syncytium is a fetal structure.

Chorio-epitheliomatous elements are also found in testicular tumors. The majority of observers draw a distinct line of demarcation between the ovarian and the testicular chorio-epitheliomata, in which pregnancy plays no part, and the uterine chorio-epitheliomata, Figure 516, which owe their origin

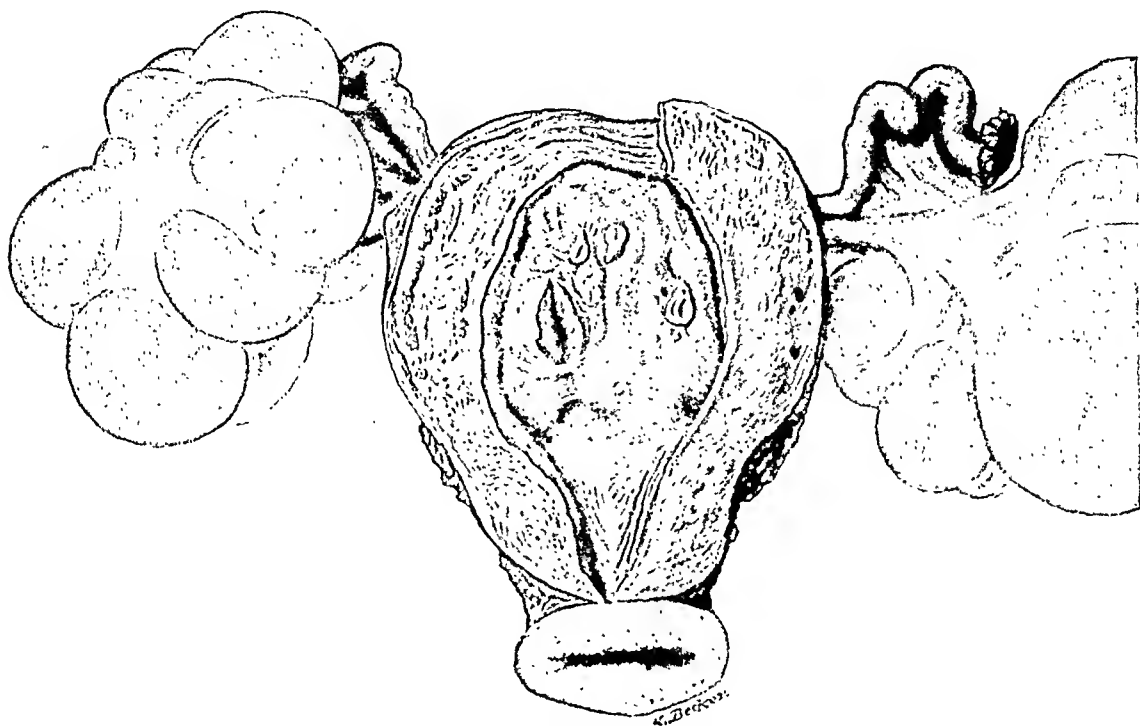


FIG. 516.—CHRONIC EPITHELIOMA OF UTERUS WITH MULTIPLE LUTEAN CYSTS OF BOTH OVARIES.
Abdominal panhysterectomy. Recovery.

directly to pregnancy. The only morphological difference recognizable, however, is that in the uterine cases the disease is directly traceable to the fetal villi.

Etiology.—The essential cause has not yet been recognized. Until the discovery of the ovarian and testicular growths, pregnancy was held to be essential. The majority follow abnormal pregnancies, such as a vesicular mole, Figure 517. In chorio-epitheliomata, the normal penetration and absorption of the maternal tissues, effected by the derivatives of the fetal trophoblast (that is to say, Langerhans's layer and the syncytium) are replaced by an unrestrained proliferation of fetal cells, associated with a general invasion of the uterine walls. The embryonic cells here penetrate the vessel walls and so enter the circulation and form metastases. In some vesicular moles, whole villi have been found in the vascular spaces, whence they are conveyed to distant points, where they either become absorbed or form tumors. Where the vesicular mole is thus reproduced in all its elements, the term malignant vesicular mole is applied. There is, however, no apparent sharp demarcation between

tumors of this nature and those in which the epithelial elements alone are found.

Structure.—*Macroscopically*, the tumor is a small, dark reddish, spongy, friable nodule, like a blood-tumor, and the metastases have a similar appearance. A group of extraordinary ovarian tumors of multiple cysts derived from an extensive growth of lutean cells is often found associated with hydatidiform cysts and chorio-epitheliomata. These tumors, always bilateral, develop rapidly, and sometimes form a mass the size of a fetal head, Figure 516.

Histologically, the tumor consists of blood spaces surrounded by the growth elements derived from both layers of the fetal ectoderm, presenting in an exaggerated manner the peculiar characteristics of such cell-elements. The syncytial masses are multinuclear with dark-staining nuclei and numerous vacuoles. The elements from Langerhans's layers are large cells with clear protoplasm and vesicular nuclei with frequent karyokinetic figures. These are more abundant about the margins and invade the surrounding muscular tissue.

Extension.—The lungs are the commonest site for metastases and continued growth, with hemoptysis, making it of the highest importance to secure x-ray pictures of the chest.

Duration.—It may be rapidly fatal, death taking place in one of Teacher's cases four months after an abortion. Again, the process is slow, extending over a year or two. Spontaneous recovery has been observed, and in a few cases removal of the primary growth

seems to have caused the disappearance of metastatic tumors. Eden and others have noted that when entire villi are found in the tumor, the disease is less malignant.

Symptomatology.—The first evidences of any growth may be discovered in metastases into the vaginal wall or in other organs, while the original growth

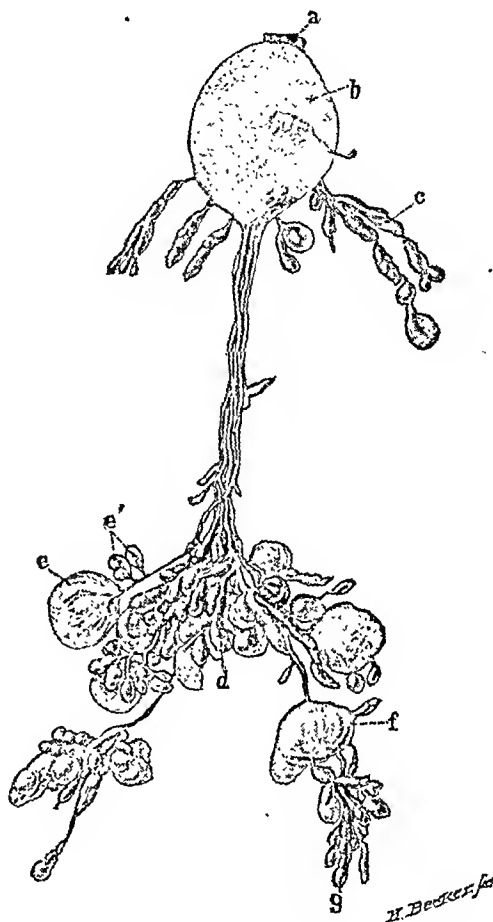


FIG. 517.—SMALL FRAGMENT OF HYDATIDIFORM MOLE.

Specimen has been floated out in water that ramifications may be seen. *a*, basal attachment; *b*, large cystic dilatation of a villus; *c*, rows of small oblong cysts. Main stem continues downward and spreads out into conglomerate mass of cysts, *d*, but just above this point it gives off a small stem of stroma ending in a cystic terminal, *e*, after giving off two terminal twigs, *e'*, with cystic ends. *f*, cystic dilatation in continuity of a villus, a short distance further on followed by terminal twig branch of cysts, *g*. (T. S. Cullen.) $\times 1$.

may have disappeared. In such a case, the primary growth has been limited to the placenta and cast off with it. Chorio-epithelioma must be differentiated from other malignant neoplasms and from hydatidiform mole. In the gross, the dark red or brownish masses made up chiefly of blood spaces are characteristic. To differentiate it from the benign mole may be difficult and all the facts of the clinical history together with the histological findings must be scrutinized and weighed in order to discriminate, and even then the diagnosis may halt in the absence of metastases. Profuse uterine hemorrhage is a characteristic manifestation, beginning a few weeks (six on an average) after the termination of pregnancy and leading to profound anemia. The interval of development extends even to a year after the previous pregnancy; where a still longer period has elapsed, as in a number reported extending even to a lapse of several years after the menopause, the question must be considered whether or not a pregnancy has occurred unobserved. Other symptoms are fetid, watery, sanguineous discharges. Pain is noted, but it is not a prominent feature. Irregular fever occurs; this in our own case, Figure 516, was unassociated with leukocytosis. The uterus is usually about the size of a three months' pregnancy.

Diagnosis.—When after an abortion, a pregnancy, or, particularly, after the discharge of a mole, there follows a watery bloody discharge, and the physician finds an enlarged uterus, the existence of a chorio-epithelioma should be suspected, especially if there are bilateral ovarian cysts. If by curetting, tissue is found corresponding histologically to chorio-epithelioma and the hemorrhages continue, the diagnosis may be sufficiently assured to warrant the prompt removal of the uterus. Great care must be taken, however, in making positive diagnosis from the curettings alone; there are border line cases manifesting all the histological appearances of chorio-epithelioma, but with no tendency to metastasize, which must be regarded as benign, or at the worst, semimalignant. This is well substantiated by the cures wrought by a simple curetting of what histologically was taken for a malignant chorio-epithelioma. There is every grade between the most benign hydatidiform mole and the most malignant deciduoma merging the two classes; these border line cases, we must remember, represent only a small percentage of the whole.

In making a bimanual examination, it is well to remember that the ovarian growths may be massive and so wedged into the pelvis as to render an operative removal apparently impossible.

Treatment.—At present the complete removal of the primary growth is the only safe method. While cases are reported in which, with the disease advanced so far as to form metastases, every sign disappeared after the removal of the primary growth, a prompt abdominal section and a panhysterectomy, including the tubes and ovaries, is the one advisable procedure. The frequently occurring anemia and general weakness demand rapid measures and

no waste of time in the preliminaries. Care to avoid contamination of the peritoneum is best effected by amputating the vagina with the electrocautery. The lower pelvis should be loosely filled with an iodoform gauze drain leading into the thoroughly cleansed vagina.

CHAPTER XXXII

ADENOMYOMA

HOWARD A. KELLY

Adenomyoma is a tumor, usually pelvic, found in, about, or adjunct to the uterus, made up of connective tissue, smooth muscle, and gland elements derived from the uterine mucosa. The uterus, itself the commonest seat, is also undoubtedly the focus and source of dissemination of this growth which is located within a limited radius at some point from the umbilicus down.

At first rare, beginning with a report by Babes (1882), followed by Diesterwed (1883), observations have accumulated until now they mount into the hundreds. Several clinical peculiarities conspire to make this gynecological entity a matter of moment—its frequent occurrence, its definite train of clinical symptoms including often severe dysmenorrhea, its wide distribution, and a complicating malignancy.

Figure 518 exhibits the various localities in which the tumors have been found by T. S. Cullen, including the body of the uterus, the rectovaginal septum, the uterine horn, the fallopian tube, the round ligament, uterine mucosa in the ovary, the utero-ovarian ligament, the uterosacral ligament, the sigmoid flexure, the rectus muscle, the umbilicus.

A thoroughgoing investigation of adenomyomata began with F. von Recklinghausen (1893, 1895, and 1896) and was conducted by Cullen, the gynecological father of this group, from 1895. One of the most perfect of all monographic summaries in our literature is Cuthbert Lockyer's, *Fibroids and Allied Tumors*, London, 1918.

Scientific interest at first centered in the etiology, von Recklinghausen considering adenomyoma as the outgrowth of dystopic embryonic wolffian elements while Cullen vigorously maintained a müllerian origin without attempting to define more precisely than to insist upon the identity of structure and response of the gland elements to the menstrual physiological stimulus.

The tumor or tumors may be found isolated in conjunction with ordinary myomata, or the uterine wall may be greatly hypertrophied with diffuse fibrous and muscular elements interspersed with uterine mucosa, some areas of which often form cysts, Figure 519. A section from this tumor, shown in Figure 520, exhibits the extraordinary distribution of the gland elements.

Cullen's view, undoubtedly correct, is universally accepted, and with the decline of his opponent's theory attempts to assign these growths to an embryonic origin have also dwindled. The evident reluctance to adopt his opin-

ion forms a curious phase in history, illustrating the force of conservatism and the difficulty of dropping once sturdily defended antiquated views for opposing new ones. The first step across from the old to the new was an acknowledgment that while some were indubitably müllerian, others were

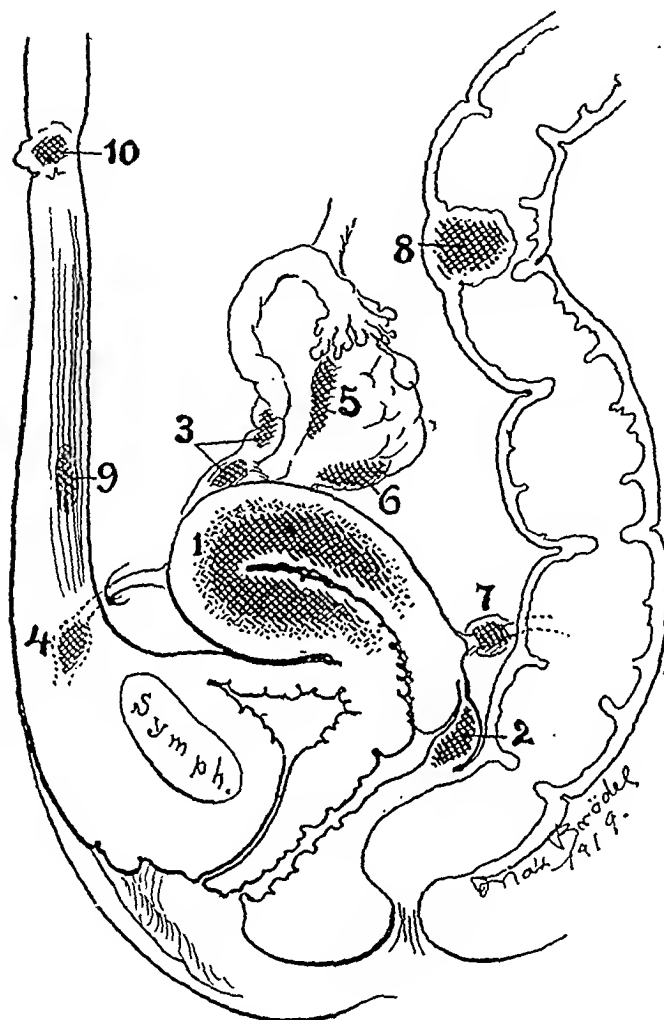


FIG. 518.—THE VARIOUS POINTS AT WHICH UTERINE MUCOSA ARE FOUND.

(1) In adenomyoma of the body of the uterus; (2) in adenomyoma of the rectovaginal septum; (3) in adenomyoma of the uterine horn or fallopian tube; (4) in adenomyoma of the round ligament; (5) in the hilum of the ovary usually unaccompanied by a myomatous growth; (6) in the utero-ovarian ligament; (7) in the uterosacral ligament; (8) in the sigmoid flexure; (9) in the rectus muscle; (10) in adenomyoma of the umbilicus. (T. S. Cullen.)

equally clearly wolfian. An early attempt to bridge the chasm was made by Kossman (1897) who assumed in support of the fetal inclusion theory that the new growths arose from accessory müllerian tubes, but this was untenable. As Lockyer declares, "Kossman's work stands out as an admirable piece of destructive criticism, but as a constructive effort it can not be said to have succeeded. In ramming von Recklinghausen's craft, Kossman sank his own also." An additional compromise was that of R. Meyer who declared that of six cornual

adenomyomata (a favorite site), three were of wolffian and three of mucosal origin.

The simple, natural, and real explanation of origin is dealt with later.

The clinical picture in adenomyoma of the uterus is characteristic—that of a periodical increased tension due to the swelling of the various islets of mucosa causing an intense grinding pain and a feeling of distention and dysmenorrhea as the effused blood is added to previous accumulations.

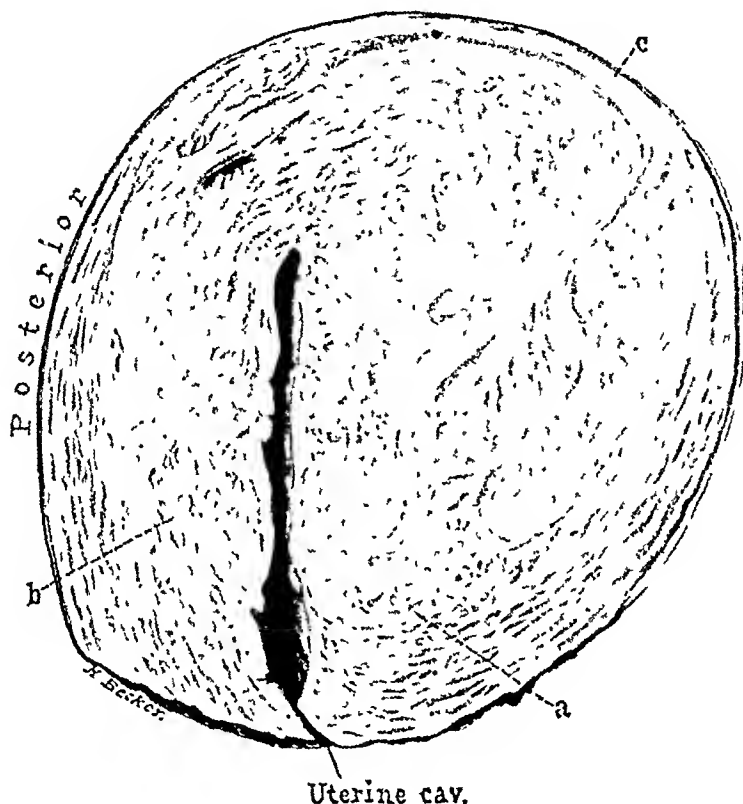


FIG. 519.—DIFFUSE ADENOMYOMA OF UTERUS IN ANTERIOR AND POSTERIOR WALLS.

New growth made up of bundles of fibrils branching and interwoven, reaching almost to peritoneum where it is covered by thin muscular layer *c*. *a* and *b* mark limits of tumor in anterior and posterior uterine walls.

If the tumor is unilateral or in the broad ligament, the pain may be localized there. In one case I found a nodule the size of a pea in the left broad ligament close to the uterus which almost made an invalid of the sensitive patient who was completely relieved after its removal following multitudinous treatments.

Where the enlargement of the uterus is hard and diffuse and the periods extremely painful, adenomyoma may be suspected. This thickening of the uterine wall can often best be recognized by a rectal examination with a sound in the uterus.

Any firm tumor in the inguinal canal, which swells at the menstrual period and becomes painful, may with confidence be labeled adenomyoma. Another clinical datum making for attacks of pain is the frequent association with a

bad pelvic peritonitis with extensive adhesions involving the adnexa. A normal pelvis with one or more lumps directly behind the cervix not associated with pelvic inflammation is almost certainly adenomyoma; a pathognomonic mark is the presence of little islets of discoloration from the effused blood. Association with small multiple myomata is fairly common. Sloughing or



FIG. 520.—SECTION TAKEN FROM UTERUS IN FIGURE 519.

a, thickness of uterine mucosa, external layer removed mechanically except small area at *b*. Uterine glands normal. At several points uterine mucosa dips into underlying muscular tissues, especially at *c*, extending to lower margin of section at *c'*. Islands of uterine mucosa at *d*, *d'*, and *e*.

gangrene does not occur but extensive cystic formation is sometimes found.

Lockyer summarizes in these words: "We must regard an adenomyoma as a hemorrhagic and painful structure which is found in bad company, its intimate associates being adnexal tumors, pelvic peritonitis, parametritis, and infiltrations into bowel, whilst it can claim caseating tubercle, carcinoma, and sarcoma as casual acquaintances."

The treatment of an adenomyoma is that of a fibroid tumor—only more intensively so—hysterectomy, or hysterosalpingo-oöphorectomy, with great attention to the details of the complete enucleation when pelvic peritonitis is emphasized (Chapter XXIV). Radium is of no avail here. In the rectovaginal

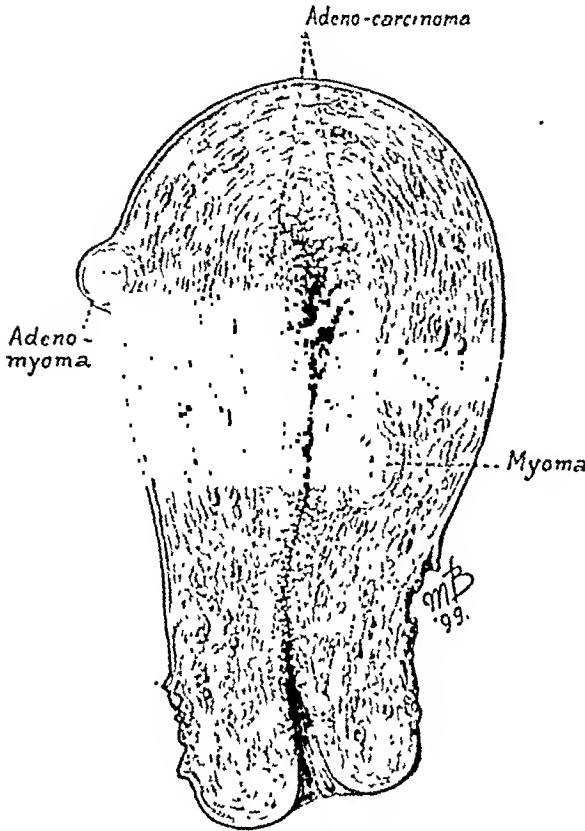


FIG. 521.—ADENOCARCINOMA OF BODY OF UTERUS; SUBMUCOUS MYOMA AND SMALL SUBPERITONEAL ADENOMYOMA.

(Cullen, *Cancer of the Uterus*, W. B. Saunders Co., p. 460.)

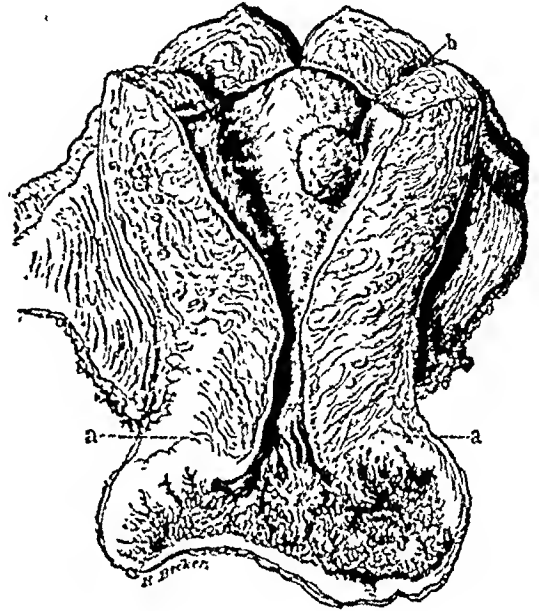


FIG. 522.—BEGINNING DIFFUSE ADENOMYOMA OF BODY OF UTERUS, ASSOCIATED WITH ADVANCED SQUAMOUS CARCINOMA OF CERVIX.

The malignant disease affects only vaginal portion of cervix. A small polyp at *b*. Median section through posterior wall shows outer normal muscular layer looking like diffuse myoma. Glands of mucosa extend in places 9 millimeters into muscularis.

septum, the disease may destroy life by its continuous lateral outgrowth which finally presses upon, invests, and constricts the ureters. It has happened occasionally that an incomplete extirpation in this locality has been followed by the disappearance of the rest of the growth. In this situation, high potency coagulation should prove of great service in destroying the disease *in situ* in situations where it is extremely difficult to extirpate on account of the contiguous rectum and ureters as well as the large vessels which upon beginning to bleed at once cause a breakdown of all the technique looking forward to a wide radical extirpation.

Lockyer concludes that “adenomyomas *may* become malignant, but that they do so very rarely. The reasons for coming to this conclusion are based:

“1. Mainly upon the investigation of a semisolid semicystic growth in the rectovaginal septum which was situated at a distance from the uterus and did not implicate the rectal mucous membrane and in which the vaginal mucous

membrane was also intact. This tumor had the structure of an adenocarcinoma.

"2. The causal relationship of chronic salpingitis with so-called *adenomyoma tubæ* on the one hand, and with *papilloma* and *adenocarcinoma tubæ* on the other, naturally leads one to the conclusion that a neoplastic process set up by chronic inflammation of a mucous membrane may result in malignancy.

"3. That an adenomyomatous change may form a benign intermediate stage in the transition from an inflammatory to a malignant process is made probable by the occurrence of tubules lined by a single layer of cubical epithelium lying in the midst of cancerous areas in cases of *adenocarcinoma tubæ*."

CHAPTER XXXIII

PELVIC ABSCESS

LAWRENCE R. WHARTON

PATHOLOGY

SYMPTOMATOLOGY

DIAGNOSIS

TREATMENT

Expectant

Vaginal Incision with Drainage

Wide Vaginal Opening with Drainage

Vaginal Incision and Drainage Followed by Abdominal Extirpation

Immediate Radical Abdominal Operation

COMPLICATIONS

POSTOPERATIVE CARE

The history of the treatment of pelvic abscess portrays in outline the whole gamut of gynecology with its record of occasional painful operations hesitatingly performed before Morton (1846) introduced general anesthesia or Lister (1862), inspired by Pasteur, brought to light surgical asepsis, while it links in a common beneficent effort noble men of all nations who achieved the birth and development of the oldest of our modern specialties—gynecology.

France records the efforts of Récamier and his pupil, Bourdon (1841), who practiced opening and draining pelvic abscesses at the vaginal vault with a sharp bistoury. Forty years passed, however, before any one followed their example on a larger scale. The successors to these pioneers were their own countrymen, Lisfranc, Chassaignac, Dumarquay (1857), Nonat (1860), and later Laroyenne (1886); each devised special trocars for the operation, while the latter insisted that the tract be kept open. In England, Spencer Wells (1865) and Savage and, in America, Marion Sims and his coadjutor, Thomas Addis Emmet (1879), with Gaillard Thomas (1880) and D. Warren Brickell (1872), led the way, practicing regularly the drainage of purulent pelvic collections through the culdesac of Douglas.

The doors of the abdomen, the surgeon's most fruitful field, previously opened a wide crack, it is true, by ovariologists and myomectomists, were finally thrown wide open by Alfred Hegar, of Freiburg, and more especially by that bizarre figure in our gynecological annals, the redoubtable Lawson Tait of Birmingham, England, in the early eighties of the last century, who projected on the canvas of his era a galaxy of brilliant operations for extra-uterine pregnancy, hydrosalpinx, and pelvic abscess, not to mention his pioneer gall-

bladder surgery. Tait, flaunting his sarcastic challenges to the English world in vain for a time, was quickly followed by the genial indefatigable Max Sänger of Leipzig, Germany, and shortly by our own eminent likewise bizarre leader, Joseph Price of Philadelphia. Since the days of these valiant protagonists, we have made no notable additions, exclusive of important bacteriologic studies and our cleaner definitions in the fields of diagnosis differentiation and technique.

Nor must we omit to mention the vaginal panhysterectomy of Péan of Paris, who described it in 1890 and recommended it in all pelvic suppurations, even advocating, on failure to remove the structures intact, digging them out piecemeal (*morcellation*), securing hemostasis by clamps left in place for forty-eight hours. His contemporaries at first dubbed his work a "disgrace to France" and a "lapse into barbarism," but he soon had a vast school of enthusiastic followers, which, however, has dwindled with time, admirable though the method was in skilled hands, notably those of another eccentric, Doyen.

It was Sänger, of philosophical mind and a wise coördinator in our gynecological literature and science, who wisely remarked (1892) that many roads lead to Rome and there are doubtless various methods of dealing with pus in the pelvis.

The term "pelvic abscess" is restricted to intrapelvic suppurations near the uterus, commonly lodged in the fallopian tubes or tubo-ovarian in form. Most of these collections of pus are the end products of a gonorrheal or tuberculous salpingitis or are the sequelæ of a puerperal infection. Another is the postoperative abscess.

We must not, however, forget that other abscesses occasionally occur with no etiological connection with the uterus and its adnexa, such as an acute appendical abscess or an iliac abscess overflowing into the pelvis from a purulent peritonitis, a sigmoiditis with perforation of the intestine by carcinoma, or tuberculosis.

Pathology.—A pelvic abscess was long thought of as located in the peritoneal cellular tissues, owing to the paucity of autopsies; a consideration of this rare puerperal condition fills the early English, German, and American textbooks under the cognomen, "cellulitis." The numerous biopsies of the later decades, however, soon demonstrated that generally the abscess seen by the gynecologist is the outcome of a gonorrheal or other infectious salpingitis with the pus encapsulated within tube or ovary. Puerperal infections, on the contrary, do usually begin as a genuine broad ligament cellulitis, extending from a streptococcus infection of uterus or a lacerated cervix and associated with thrombophlebitis and septicemia. In this type, tubes, ovaries, and peritoneum often escape, and the inflammation remains extraperitoneal and in the cellular parametrial tissues, strikingly different, therefore, from the intraperitoneal forms. (See Figure 314.)

When the abscess is large, it is hard to tell whether the pus is enclosed within the tube and ovary or lies more or less shut off by adhesions in the pelvis. Both conditions occur simultaneously when a pyosalpinx or a tubo-ovarian abscess leaks and forms a pool of pus which fills the pelvis and even extends up among the coils of intestine, or is shut off in the retro-uterine culdesac.

Douglas's pouch is the commonest extension. It sometimes burrows behind the rectum or down into the rectovaginal septum to form indurated masses



FIG. 523.—ACUTE SALPINGITIS WITH PYOSALPINX.

Section of fallopian tube showing thick edematous tube wall with infiltration of inflammatory cells and endosalpinx seat of intense inflammation with free pus in lumen of tube. $\times 25$.

almost obliterating the rectal lumen. It rarely appears between uterus and bladder. Those lodged within the broad ligaments tend to burrow extraperitoneally and to point in the groin or even in the flank. Rarely do they burrow up along the urachus to open at the umbilicus.

An untreated pelvic abscess is either chronically shut off in one or both tubes or drains freely by the uterine or ruptures into the peritoneum, vagina, rectum, or bladder. Neglected cases are not seen so often as formerly, owing to our numerous hospitals and general knowledge of the resources of surgery.

Rectal stricture is a not uncommon complication, due either to pressure or to proctitis; this may lead to chronic obstruction. The ureters also are sometimes partially blocked, creating hydro-ureter, hydronephrosis, or pyelo-

nephrosis, not an uncommon picture clinically and at autopsy. The damage done the kidneys may be serious and permanent.

Peritonitis develops either suddenly from a ruptured abscess or by gradual extension from the focus of infection. As the organisms are usually dead, the symptoms are often far from being as grave as those arising from an appendi-



FIG. 524.—ACUTE SALPINGITIS WITH PYOSALPINX.

Higher power showing marked infiltration of endosalpinx with leukocytes and free pus in lumen of tube. $\times 50$.

citis. An associated appendicitis should always be looked for at an operation for a pelvic abscess.

Symptomatology.—The symptoms may be acute or chronic. In the acute, there is intense pelvic and lower abdominal pain, and the patient lies with knees drawn up and a distressed expression. The temperature is elevated and the pulse quickened and the local tenderness points to a severe inflammation. From the general abdominal tenderness and distention often present, the physician may infer that there is a general peritonitis.

In the acute gonorrhœal form, the abscess is apt to be preceded by inflammation of urethra, vulva, and vagina; when it is chronic, on the other hand, the disease may be larvate and without decided symptoms and the causal relation puzzling. The increment is then gradual—dull pains in the ovarian regions, a slight rise in the temperature, some pain in micturition and defecation. With the formation of pus, there may be chills, but not as often as in the graver types. The pulse is good, there is little or no vomiting, and the general condition is excellent.

Nausea and vomiting are relatively common in an early acute salpingitis.

In a streptococcus infection, the attack usually dates from a confinement, an abortion, or an intra-uterine treatment. The onset is sharp with a chill, high fever, and rapid pulse. Peritonitis and septicemia often develop, the course is tempestuous, and the prognosis far graver than in any other type. The patient also is bedridden from the beginning.

If the abscess is small, it is absorbed after a limited period of invalidism, or the pelvic organs survive with tubes and ovaries suowed under a mass of adhesions. Permanent recovery takes place at times after the spontaneous rupture into the vagina with its dependent drainage.

Diagnosis.—The diagnosis of an abscess in the tubes and ovaries is usually easy.

Vaginal examination reveals a cervix more or less fixed with uterus wedged between masses occupying the right and left posterior quadrants of the pelvis, which are dense, hard, fixed, and sensitive, or there is a rounded sensitive mass on one side at the vault.

Bimannual examination does not at first outline the diseased structures but confirms the vaginal touch, revealing a dense resisting pelvic floor and a posterior pelvis choked on one or both sides. Such findings suggest the diagnosis at once.

A more careful questioning and gentle and easily tolerated palpation by a trained hand as a rule differentiate one or two groups of masses and define their exact location and a slight but definite mobility independent of the uterus. A sense of fluctuation not too pronounced is occasionally felt, especially in a pus sac bulging into the vagina. An old accumulation of pus may only feel like a small hard tumor lateral to the uterus.

A rectal examination is indispensable to discover any point of softening and the extent to which the bowel is bridged over and splinted in the enveloping masses.

One ought not to be hurried into an operation by the peritoneal symptoms present in the early stages of an acute salpingitis which is clearly not streptococcal; the peritonitis attending an acute gonorrhœal salpingitis usually subsides with expectaney. When, however, a patient with a localized, chronic, suppurative lesion develops nausea, vomiting, general abdominal tenderness, muscle spasm, and rigidity, we are confronted with a more serious situation and

an immediate surgical intervention may be imperative. The temperature is often high with a leukocytosis, particularly in the puerperal series. Old dead abscesses, however, are often cold. The pulse rate was increased in most of our series to over 100. Occasionally, one sees bradycardia, leukopenia, and subnormal temperature. One of our patients had a large pelvic abscess, a temperature of 107.8° , and a white blood-count of 6,280, and recovered.

Treatment.—Some form of active surgical interference is the prevailing rule. Just before operating, the surgeon should examine again bimanually and orient himself as to what he is likely to find.

The treatment of any pelvic abscess not of the streptococcus or tuberculous type is by one of the following methods, more or less an expansion of the old surgical dogma, "*ubi pus ibi evacua!*"

Expectant treatment is often advisable in early acute infections, as a large experience has demonstrated that many get well with rest in bed, hot vaginal douches, an ice-pack to the lower abdomen, and by keeping the lower bowel empty and diet restricted, and often bear children.

Where the symptoms are aggravated, F. Henrotin has practiced with notable success a posterior *vaginal incision with drainage*, affording immediate relief. His procedure is a transverse incision in the vaginal vault, if necessary enlarged by a T-shaped incision, with a blunt dissection up behind the cervix, hugging the uterus, then opening the peritoneum with a blunt scissors and introducing the finger for exploration. A bimanual examination now offers the utmost facility for investigation and the breaking up and evacuation of any serous or purulent accumulations. A liberal loose drain is introduced for five days or more.

Expectancy is also often the wise rule in acute exacerbations of a localized pelvic peritonitis. After this has subsided, there is time to consider operation. Where it is a question of a spreading peritonitis, it may be difficult to decide whether to wait or whether to explore the abdomen. If the general condition is good, it is better to make an exploratory operation, usually under local anesthesia, rather than to take a serious chance.

A wide vaginal opening followed by drainage constitutes the best possible treatment of a group at the opposite pole to those just considered; that is, the old large localized pelvic abscesses demanding operation. If let alone, nature often finds her own exit either by the vagina or the rectum albeit an imperfect one which, as a rule, closes too soon. Improving the practice of our forefathers who waited for the septum to soften and point, the surgeon of to-day anticipates nature's accidents and saves life, suffering, and destruction of tissue by boldly invading the pelvic peritoneal cavity and breaking open the sac and draining the pus long before nature is ready. A localized pelvic inflammatory mass can always be opened without risk through the vaginal vault and drained effectively, promptly relieving and usually curing the ailment. After such

efficient drainage, the question arises whether or not it is best later on to extirpate the diseased structures by the abdominal route.

Vaginal Incision and Drainage Followed by Abdominal Extirpation.—If the patient is very sick and there is an obviously accessible abscess, it is best to open and drain it by the vagina, an operation lasting from one to ten minutes and giving immediate relief without risk. Then in a few months, under more advantageous circumstances, the more radical abdominal operation can be done if troublesome symptoms persist.

The vaginal drainage operation calls for thoroughness in (1) a good wide incision, (2) evacuation of all abscesses, and (3) liberal drainage for several weeks. The incision in the vault must be made wide enough by a blunt traction to right and left to admit easily two fingers or more. After evacuation, try with the finger tips to remove the lining of the abscess as it will thus heal faster. Then, bimanually, with a finger in the pelvis and the other hand pressing down from above, try to discover and open other abscesses higher up, sometimes even using a long blunt artery forceps to break through the sac wall. Good drainage afterwards forbids any trouble from opening the peritoneum. After the operation, the drainage tract must be kept open for several weeks and healed up from the bottom. If it tends to close too soon, the opening in the vault must be opened again with dilators.



FIG. 525.—EXPOSURE OF PELVIC PERITONEUM IN POSTERIOR COLPOTOMY. CERVIX DRAWN FORWARD, VAGINAL MUCOSA INCISED, PERITONEUM OPENED AND ABSCESS EVACUATED. (Kelly-Noble, *Gynecology and Abdominal Surgery*, W. B. Saunders Co.)

Another application of this drainage method is in old advanced cases when on opening the abdomen the pelvis is found so choked with dense inflammatory masses that eradication of the disease from above can not be done without extreme risk of life. In such an one, with the abdomen open, and the intestines packed off, turn to the vaginal route, put the patient in the lithotomy posture, open the posterior culdesac, and explore the pelvis on all sides, breaking up and draining the abscesses, aided by the hand inside the abdomen. It will take a little planning to avoid contamination of the abdominal wound.

Almost 90 per cent leave the hospital free from pain, but in only 10 per cent is the pelvis free of masses, unusual induration, or evidences of chronic inflammation. Symptomatically, therefore, the immediate results following the drainage by colpotomy are most satisfactory. The end results are surprisingly good, also, although not fully substantiating the claims of the early originators of the operation. Twenty-five per cent of our patients have been perfectly well for periods of from three to twenty-five years; 25 per cent im-

proved so that they needed no further treatment; 50 per cent were benefited temporarily and subsequent radical pelvic operations had to be done.

The *immediate abdominal operation* is best wherever the operation does not bid fair to endanger life, where the patient has been a sufferer for a long time, where drainage has already been done and symptoms persist, or in women near or beyond the menopausal period where the operative risk is evidently good. This operation is the neatest and the most likely to yield immediate excellent results.

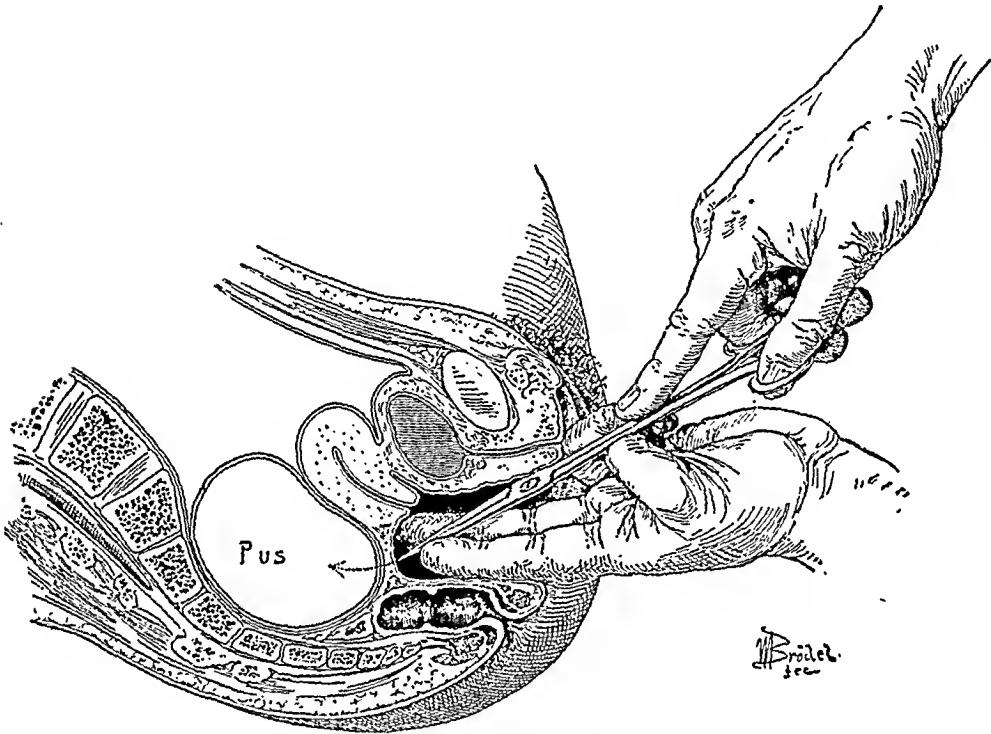


FIG. 526.—PUNCTURING A PELVIC ABSCESS.

Instruments should follow course of arrow, avoiding rectum, uterine artery, and vein.

In the effort to conserve the functions in young women, it is well to keep a sound tube and a sound ovary, even on opposite sides, along with the uterus, preserving the menstrual function and the capacity for conception. Nearer the menopause, conservatism must take only a subordinate place.

The abdomen is opened, by a liberal incision in younger women, the table elevated, the surrounding viscera packed off, and the entire field inspected to decide upon the best plan of attack. If there is pus in both tubes, both should be removed; one or both ovaries if sound should be preserved. The enucleation of the tube begins often with a wedge-shaped excision at the uterine cornu, liberating the uterine end of the tube which is then lifted up as it is and freed step by step from its broad ligament attachment, catching bleeding vessels as they appear, until the fimbriated end is reached. It may take a little blunt dissection with the fingers to free and lift the distal end up from the pelvic

floor. The vessels are then tied or coagulated and raw areas whipped together with a fine continuous catgut suture. If both tubes are badly infected, both are removed in the same way, and both ovaries conserved.

If in any case the abscesses are large or the risk of rupture seems great as they are extirpated, it is well to use a suction pump to collapse before handling them, limiting the peritoneal contamination.

When both tubes and ovaries are to be sacrificed, it is then best to clean out the pelvis by removing the uterus. This is sometimes best done by a longitudinal bisection of the uterus in its entirety, removing each half with its dependent ovary and tube, and leaving in a vaginal drain (Chapter XXIV).

In any radical operation, whether of the lateral structures or of the uterus with lateral structures, it may be necessary, either by reason of density of adhesions, or of risk of hemorrhage, or of opening up a badly infected area and exposing the peritoneum to prolonged contamination, to abandon all routine bench rules and to proceed cautiously on the plan of catch as catch can; that is, to begin the enucleation wherever there is an opening and to release as far as safe and then to begin elsewhere and continue until one has isolated on all sides of the forbidden area which is tackled last and usually found comparatively easy to handle. The only mistake one is likely to make in doing this is that of pushing too far in one direction and using force. Trained fingers soon detect limitations and quit when the lead runs out; also, it is vital to keep the finger tips turned toward and hugging the structure to come out and, if there is any rubbing, to rub on it and not on the enveloping structures.

Complications.—When the abscess sac adheres to the pelvic wall or floor, it is best to cut the sac away on all sides and leave the patch untouched until the completion of the extirpation. Then one can destroy and sterilize the surface with desiccation or coagulation or, if it lies on the bowel, invert it on itself by a few mattress-sutures. Complicated cases should be drained by the vagina.

In the Johns Hopkins Hospital, during the twenty-four years preceding 1915, in 871 of these operations, the rectum was torn or punctured during the course of the operation in ten; in one the perforation came from the pressure of the finger during rectal examination.

Twelve developed rectopelvic vaginal fistulas; a common cause of such injuries in the early days was undoubtedly the glass and hard rubber drainage tubes as well as operative injury in handling dense adhesions or the spontaneous sloughing of a necrotic rectal wall. Two-thirds of the fistulas healed within three weeks; the further history of the rest is not known. If the perforation is low down, rectal irrigations hasten the healing.

Significant bleeding occurred twelve times, usually from vaginal veins; in one the uterine vessels were injured. It has always been checked by hemostats or packs.

Postoperative Care.—The postoperative care consists in a complete rest, with regulation of the functions, while keeping a watchful eye upon the temperature and the discharges in the drained cases with a view to removing the drain when it ceases to act. After the patient has left the hospital, she must be kept under observation for some months until it is clear that there is no lingering infection left.

CHAPTER XXXIV

GONORRHEA

LAWRENCE R. WHARTON

GONORRHEA IN WOMEN

Incidence

Pathology

Bacteriology

Site

1. EXTERNAL GENITALIA AND CERVIX

Symptomatology

Examination

Treatment

(a) Acute Stage

(b) Chronic Stage

2. INTERNAL GENITALIA

Body of the Uterus

Fallopian Tubes

Ovaries

Peritoneum

GONORRHEA IN CHILDREN

Pathology

Contagion

Clinical Course

Treatment

Prognosis

GONORRHEAL SALPINGITIS

Acute Stage

SYMPTOMATOLOGY

DIAGNOSIS

TREATMENT

Chronic Stage

SYMPTOMATOLOGY

TREATMENT

GONORRHEA IN WOMEN

A survey of the steps marking the progress of our knowledge of venereal diseases goes back to the beginnings of history, the literature of many early civilizations containing specific references. In spite of this, however, for almost thirty-five centuries, ignorance of etiology, clinical significance, pre-

vention, and cure reigned supreme, any real knowledge being of but recent acquisition and dating only from the nineteenth century. It is not strange, therefore, that this preëminently infectious disease is rampant to-day throughout the habitable globe.

Ancient Greece and Rome with their decadent immoralities apparently labored under their attendant luetic infections. Gonorrhea was so named by Galen about 150 A.D., who considered it a seminal discharge. The complete dossier of gonorrhea only arrived after centuries of fruitless groping, confusion, and tragedy. Four names stand preëminent: Ricord (1838), who showed that gonorrhea and syphilis are distinct; Noeggerath (1872), who pointed out the clinical characteristics of gonorrhea in women; Neisser (1879), who found the gonococcus; and Lawson Tait, who in a sense ushered in the modern era of abdominal surgery and provided the opportunity for pathological study of the disease.

Incidence.—The incidence of venereal disease is an index of the moral standards of society. This appears in the routine Wassermann records of the Johns Hopkins Hospital. In the gynecological service for two years preceding 1921, 3 per cent of the white and 18 per cent of the colored had syphilis. In 1920, J. W. Williams reported that out of four thousand women applying for delivery, 2.48 per cent white and 16.29 per cent colored were affected. Recently, Moore and Keidel presented findings in 7,154 consecutive medical patients during 1918-1922; in the private wards, 7.1 per cent males and 2.4 per cent females were syphilitic; in the white public wards, 10 per cent males and 4.1 per cent females, and in the colored wards, 25.8 per cent males and 20 per cent females yielded a positive Wassermann. The results of these laboratory tests agreed closely with the clinical diagnoses.

It is harder to determine the incidence of gonorrhea. In the same institution in recent years about 10 per cent of the gynecological operations performed on whites and 33 per cent on colored have been for gonorrhea and its sequelæ.

These records demonstrate that generalizations compiled from a single social stratum, as to the frequency of venereal diseases, are misleading when alleged of the population as a whole. The incidence among the morally and intellectually untutored and irresponsible is undoubtedly appalling, and the ugliness of the stigma is not lessened by the fact that these are of all diseases

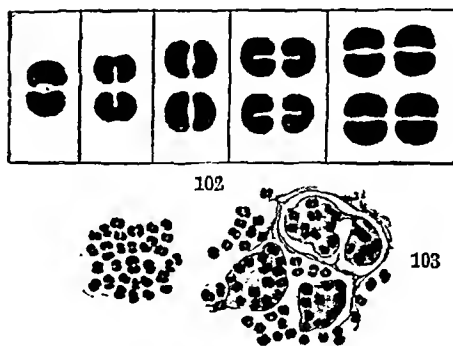


FIG. 527.—THE GONOCOCCUS.

Method of staining: Gentian violet, two minutes. Wash with water. Gram's iodine solution, two minutes. Decolorize for a few seconds with ethyl alcohol, 95 per cent. Wash with water. Counterstain with safranin, aqueous solution, 1 per cent. Wash with water. Gram-positive organisms appear deep brownish-black; Gram-negative bright red.

the most preventable, being the natural fruit of licentious gratification. The saddest part of the picture is that the heavy penalty often falls on innocent infants, children of the second and third generation, young girls, and blameless wives. Prevention, therefore, becomes both a social and a medical problem of the first magnitude, demanding the whole-hearted coöperation of all physicians, the key to which problem lies in the home life and the moral and religious education of our youth.

Pathology.—The gonococcus primarily attacks the mucous membranes, producing an acute inflammation which, on the superficial and exposed surfaces of the vagina and vulva, rapidly subsides. The peccant organism, however, tends to invade the deeper glandular periurethral structures, the glands at the introitus, the cervix uteri, and the fallopian tubes, where it lingers firmly entrenched, causing destructive chronic inflammations with irregular periodic acute exacerbations. When the fallopian tubes are infected, a train of grave secondary intraperitoneal complications often ensue, with the formation of pyosalpinx, tubo-ovarian abscess, pelvic abscess, fistulas, and localized and even general peritonitis, to which manifold lesions, the generic term pelvic inflammatory disease is applied. Of the extra-urogenital lesions, the most important are ophthalmia, proctitis—often with rectal stricture, arthritis, endocarditis, and rarely a florid septicæmia, and death.

No active immunity is conferred by an attack, nor is there any way of conferring artificial immunity. It is true that those who have recovered symptomatically may be exposed many times without a fresh infection, but this is because they have never been free of the disease in its latent form. Such persons can transmit it to others and are liable to an acute flare-up at any time.

Bacteriology.—It is easy to find the gonococcus in acute infections, but in chronic lesions it becomes difficult and often impossible. The frequent secondary invasion by other organisms adds to the diagnostic difficulty as the delicate gonococcus succumbs in the presence of these congener bacterial weeds, nor is there anything specific in the microscopic picture of the gonococcal tissue lesions. Therefore, the diagnosis of a chronic gonorrheal salpingitis, cervicitis, bartholinitis, oöphoritis, peritonitis, and pelvic abscess, being rarely supported bacteriologically, must lean hard upon the clinical history, the gross pathological findings, and the exclusion of other factors.

In fully two-thirds of all chronic pyosalpinx cases, the fluid is sterile; the gonococcus is found in from 5 to 15 per cent, dependent upon the age of the lesion and the technique; in the remainder (20 to 30 per cent) the organisms are colon bacillus, streptococcus, staphylococcus, diphtheroid bacillus, and atypical unidentifiable bacteria.

The gonococcus is occasionally noted in stained pus smears when cultures are negative; it is also cultivated from an infected tubal wall by macerating the tissue and implanting it on suitable media. In general, the older the lesion, the rarer the organism.

Site.—1. *The External Genitalia and Cervix.*—The portal of entry is the external genital tract and the earliest sign in adults is an acute inflammation of vulva, vagina, urethra, Bartholin's glands, Skene's glands, or cervix. Urethra and cervix are the structures commonly involved. The primary manifestations vary widely in extent and severity; in some the inflammation is limited and insignificant, while in others the entire mucosa of the external genitalia and cervix becomes red, edematous, and sensitive, exuding a purulent secretion with myriads of gonococci. The orifices of the urethra, Skene's, and

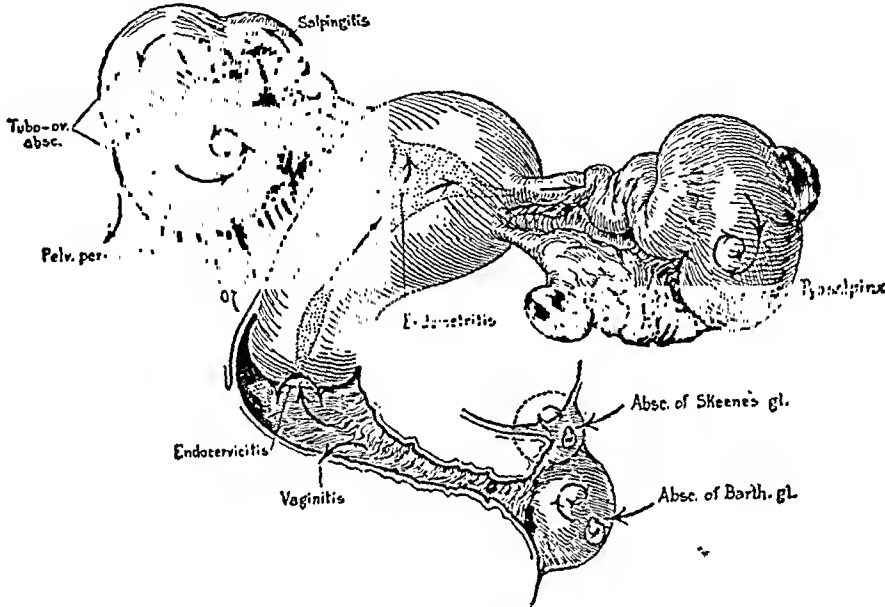


FIG. 528.—CHIEF LESIONS OF GONORRHEA.

Skene's glands; Bartholin's glands; vagina (in children); cervix; endometrium; fallopian tubes; ovaries; peritoneum. Whorled arrows mark common sites of infection.

Bartholin's glands (maecula gonorrhoeica) appear reddened, and the urethra is swollen and everted, thickened, and purplish. The cervix losing its pallor becomes reddened, enlarged, and edematous, and excretes a characteristic tenacious mucopurulent discharge—a pathological picture hardly duplicated by any other condition than an acute gonorrhea.

The visible intense inflammation subsides in several weeks, to remain chronic in the deeper cervix and in Bartholin's and Skene's glands. In the cervix, the organisms invading the racemose glands and occluding their ducts, produce a deep chronic inflammation with hypertrophy and a surface studded by nabothian cysts bathed in a thick mucoid or mucopurulent discharge. The area about the os is red, and the squamous epithelium is replaced either in part or completely by a superficial layer of granulation tissue bleeding easily on touch. This "erosion" or "eversion" of the cervical mucosa is not pathognomonic of gonorrhea but may result from any chronic infection and is sometimes seen without it. At times the exuberant granulations form polyps and, rarely, condylomata.

curochrome, 20 per cent, tincture of iodine, silver nitrate, 5 to 15 per cent, or acriflavin, 1:1,000, are useful topical applications. Tampons saturated with ichthyol, protargol, or argyrol, still used by many, should be removed in twelve hours and followed by vaginal douches twice daily. The following douche powders are helpful:

R

THE P.M.C. DOUCHE

Acid. Bor.	5	iv
Pulv. Alum.	5	iv
Pulv. Phenol.	5	ii
Ol. Menth. Pip.	5	i ss.

S. Mix well. A teaspoonful in a quart of warm water as a vaginal douche.

R

THE A.B.C. DOUCHE

Pulv. Alum. Exsic.	5	i
Phenol.	5	i
Acid. Bor.	5	vi
Ol. Gaulth.	5	i
Ol. Menth. Pip.	m	xxx

S. A teaspoonful in a quart of warm water as a vaginal douche.

All lingering organisms must be killed, often accomplished only by a direct application of the actual cautery (*cuprum* or *ferrum candens*) or by excising the glands in which they are nested.

In old Bartholin or Skene gland infections, local applications are futile and surgical measures which fall short of the destruction or removal of the infected tissue are often followed by recurrences. In such, the only curative procedure is the complete excision of the infected glands or their destruction by cautery; here, electrotherapy (endothermy) is invaluable (Chapter XLVIII). The most favorable time for excision is when the gland is distended by secretions and its anatomical limits clearly defined; this can often be done without rupture, followed by complete hemostasis and closure of the wound with prompt healing. It is usually wise to provide temporary drainage by a small rubber protective wick. In the case of an abscess, the endothermic coagulation current may often be used to advantage to destroy the whole lining membrane after incision, leaving the wound to granulate.

The periurethral glands (Skene's) are superficial and easily destroyed by introducing a blunt needle and turning on the endothermic desiccation current for a few seconds, under local anesthesia. It remains to be seen what the injection of a 20 per cent solution of mercurochrome will do here.

Chronic urethritis is treated by the direct application of the silver salts or of mercurochrome; it is often well to overcome urethral spasm by a careful overdilatation, as high as 12 millimeters in diameter, which promptly gives great relief.

The treatment of chronic cervicitis is discussed in Chapter XVI.

Condylomata or benign warty growths spring from a chronic inflammation and consist of a core of subcutaneous tissue covered by surface epithelium; these sometimes form in great numbers on the mucous membrane of cervix, vagina, vulva, and perineal and perirectal skin; the massive forms are commonly in low-class prostitutes. Although usually associated with uncleanness, they also develop in spite of all sanitary precautions, especially in the pregnant woman. The typical condylomata acuminata of gonorrhea are small, round, pedunculate, or sessile warts; syphilitic vegetations are oftener flat and broad (condylomata lata). The gonorrheal forms are extremely persistent, attaining considerable size, and form extensive coarse coalescing vegetations. Exposed and constantly moist, they ulcerate and slough and pour out a loathsome discharge.

Before beginning treatment, syphilis must be excluded; if found, an intensive antisyphilitic therapy often banishes the lesions. Extensive cervical growths at first sight resemble cancer; consequently, the diag-

nosis must hinge upon the microscopic examination. Being resistant to conservative measures, they are best cleared up by actual cauterization or the endothermic loop and coagulation. Vaginal lesions, covered only by mucous membrane, yield promptly to caustics and endothermy. The thick skin protecting the perineal growth renders local applications futile and surgical excision or cauterization is unsatisfactory because of the slow healing of the infected wounds. The ideal treatment is desiccation or coagulation by electricity, an office procedure when the lesion is not large. One must always keep up a battle against the irritant provocative discharge, whether from vagina, cervix, uterus, or tubes, to prevent a recurrence.



FIG. 529.—VENEREAL WARTS.

Vegetative growths situated on perineal skin, labia, or vagina. (C. C. Norris, *Gonorrhea in Women*, W. B. Saunders Co.)

2. *The Internal Genitalia.*—*Body of the Uterus.*—The greatest havoc wrought by the gonococcus is in the fallopian tubes. Unlike the streptococcus traversing the broad ligament lymphatics, the gonococcus gains its access to the tubes through the uterine cavity where it rarely leaves any significant changes, as even in bilateral pyosalpinx and cervicitis, the corpus uteri usually remains normal. In the periodic regenerations of the endometrium probably lies the explanation. A gonorrheal endometritis may occur with a lowered resistance, as after injudicious instrumentation, a miscarriage, intra-uterine polyps, or an overwhelming infection of the fallopian tubes or cervix. The

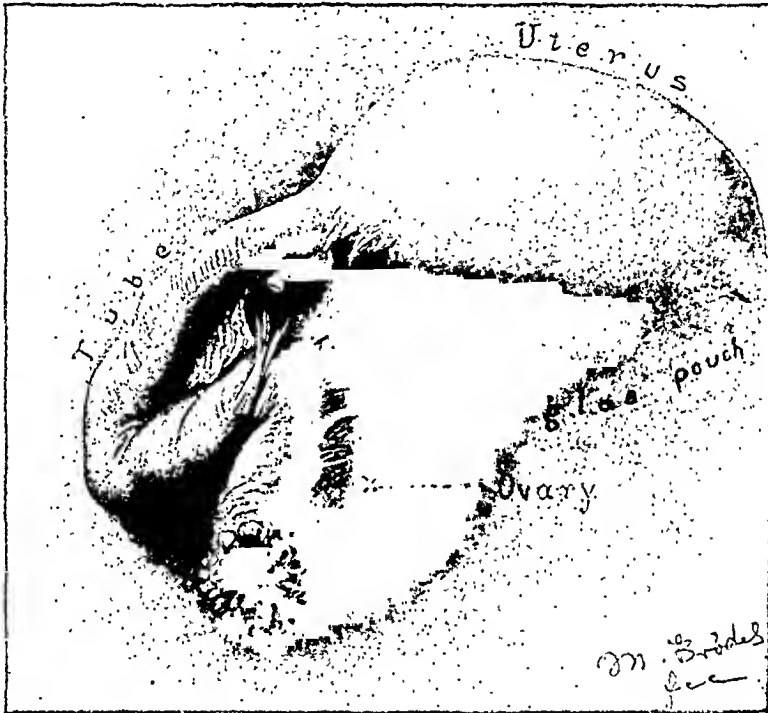


FIG. 530.—TUBAL ADHESIONS.

Fimbriated extremity open, but median portion kinked by fibrous band. Such lesions may cause sterility or favor tubal pregnancy.

mucous membrane as well as the musculature of the uterus may be infected with abscesses burrowing into the uterine wall.

Fallopian Tubes.—It is estimated that between 50 and 75 per cent of all inflammatory lesions of the fallopian tubes are gonorrheal, 7 per cent are tuberculous, and the remainder largely follow puerperal infections—streptococcus, staphylococcus, or colon bacillus.

In the acute stage of a gonorrheal salpingitis, the fallopian tube is swollen, pouting, red, and edematous; the thickened visible mucosa is deeply injected, and pus laden with gonococci exudes; the adjacent pelvic peritoneum shares in the reaction. The heavy engorged tube drops to the pelvic floor, carrying the ovary with it, where it adheres and becomes occluded—nature's protective device against a more generalized peritonitis.

...ns access
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PLATE III.—ACUTE PYOSALPINX.

Right tube in same condition removed several weeks previously, the left being preserved in hope of recovery. Acute inflammation evident; peritoneal surfaces injected; convoluted fallopian tube distended with yellow pus, tense, hard. Fimbriated extremity buckled in and closed. Fibrous adhesions not yet formed. Four small myomata.



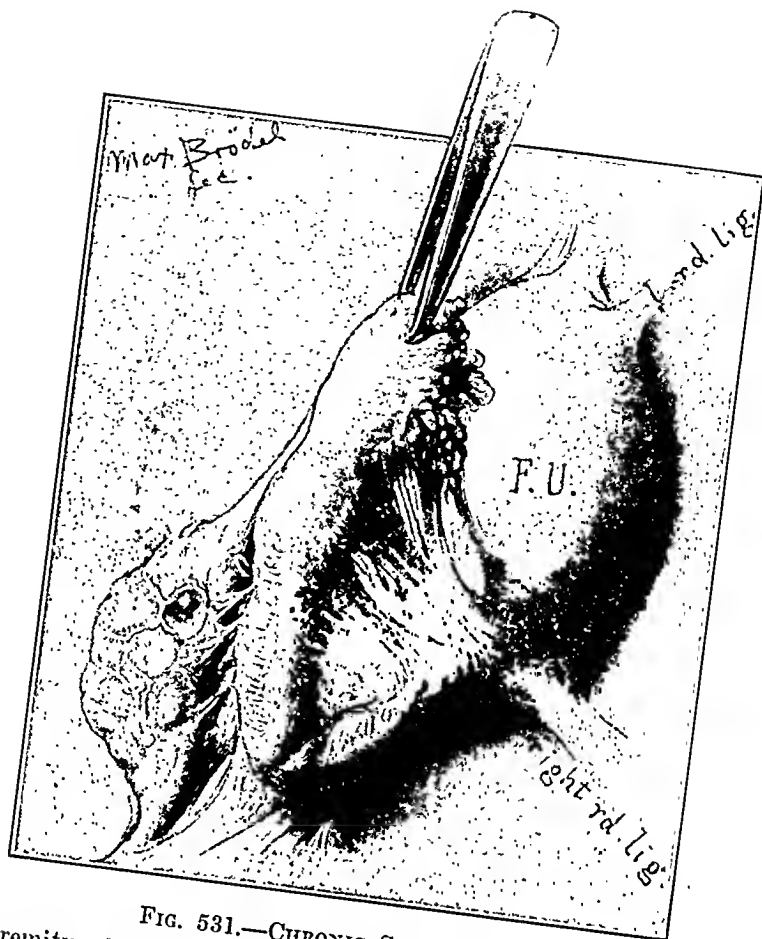


FIG. 531.—CHRONIC SALPINGITIS.
Fimbriated extremity of tube closed; tube slightly dilated by enclosed fluid (hydrosalpinx); signs of former pelvic peritonitis found in light adhesions that extend from tube to uterus and ovary.



FIG. 532.—SALPINGITIS ISTHIMICA NODOSA—NODULAR SALPINGITIS.
Frequently gonorrheal; occasionally tuberculous. Nodular thickening often limited to interstitial portion of tube, which then stands out prominently above uterine wall.

With the subsidence of the acute reaction, the redness fades away, the finer adhesions melt, and in a mild infection the tube may become functionally normal; usually, however, the tubal damage is permanent. If the purulent

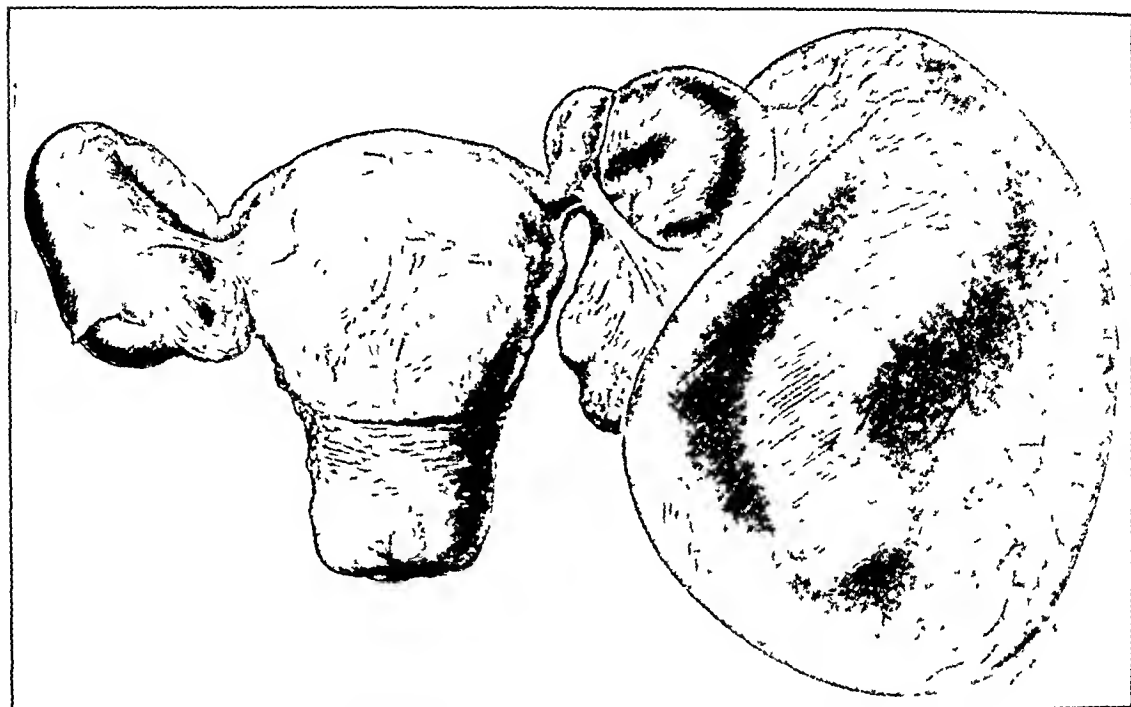


FIG. 533.—BILATERAL HYDROSALPINX WITH NUMEROUS ADHESIONS WHICH KINK TUBES AND BIND POSTERIOR SURFACE OF UTERUS TO RECTUM.

contents escape into the pelvis or out via the uterus or are absorbed by the lymphatics, the tube may shrivel and lie curled around the ovary, adherent to the posterior surface of the broad ligament, the rectum, or the pelvic floor.

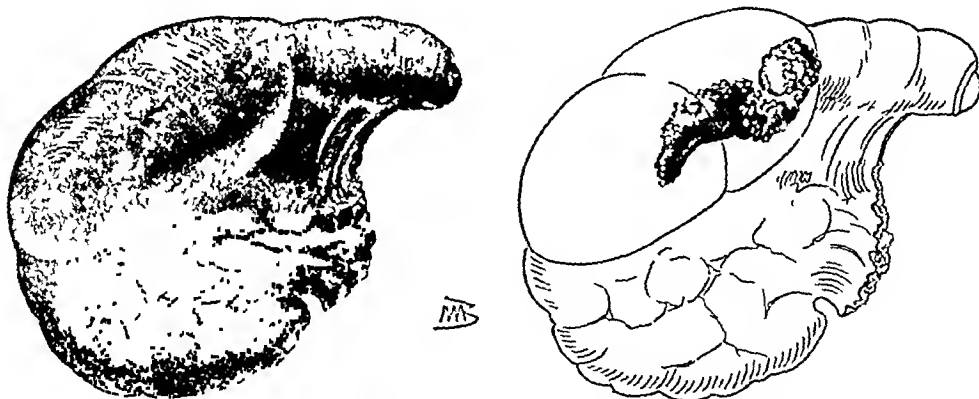


FIG. 534.—HYDROSALPINX CONTAINING NODULAR S-SHAPED CALCULUS IN LUMEN OF TUBE, ADHERENT TO OVARY.

Calculus shown in detail in outline figure to right.

The omentum is often fixed by old fibrous adhesions to the site of the infection. Such a tube loses its soft, delicate flexibility, to remain thickened and cordlike with inflammatory nodes. The interstitial portion stands out above the uterine

cornu as an edematous, indurated, nodular ridge, the site of the chronic infection (salpingitis isthmica nodosa). The fimbriated extremity is closed and the continuity of the lumen interrupted by adhesions gluing the tubal walls together. While such a condition may remain dormant for years, an acute activation may arise at any time.

When the purulent contents of the tube are not absorbed or evacuated but continue to accumulate, an abscess forms within the lumen (pyosalpinx) which swells and takes the form of a retort or a pipe or appears convoluted, forming a mass at times even palpable through the abdominal wall; such a pyosalpinx has been known to contain as much as a liter of pus.

A common pathological sequel to a chronic salpingitis is a hydrosalpinx, a thin-walled sac containing a watery fluid. This may also follow the accumulation of serous secretions within the closed tube without pus; it also probably represents a conservative stage in a pyosalpinx in which the pus has been absorbed and the inflammation has subsided. In hydrosalpinx the tube is tense, distended, and its walls attenuated by the pressure of the fluid. The epithelium is flattened out and the branching folds of mucosa pressed against the walls are greatly shortened and almost rudimentary. Signs of inflammation are usually conspicuously absent.

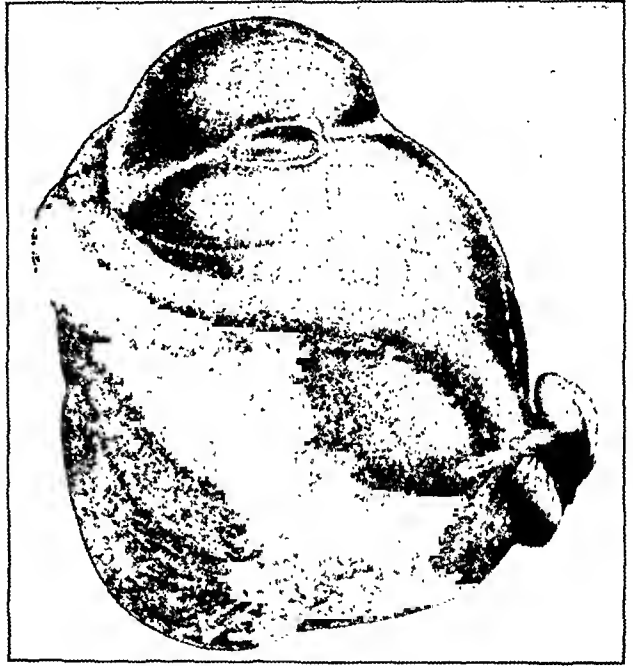


FIG. 535.—TUBO-OVARIAN CYST.

Uterine tube crosses in form of an S, its right extremity sharply kinked and continuous with excised uterine cornu. Tube ends in domelike prominence lying on top of ovary. Small subperitoneal collection of clear fluid (encysted peritonitis) marks line of adhesion between tube and ovary.

Occasionally both the fallopian tube and its ovary unite to form a tubal-ovarian cyst. Dissection usually shows that the two cysts are independent and the passage fortuitous.

Ovaries.—Fifty years ago, gonorrheal oöphoritis was considered common, but time and observation have shown that it is in reality rare, attributable it appears to the thick tunica albuginea. Even in the embrace of the inflamed tube and the bath of exudate, the infection rarely penetrates the thick ovarian capsule or destroys its function. The commonest lesion is a perioöphoritis, affecting the surface which then becomes thickened and interferes with the

periodic rupture of the follicles, causing dysmenorrhea and retention cysts. The gonococcus at times penetrates the capsule at the point of rupture of the follicle and reaches the retention cysts and eventually transforms the whole into an abscess.

In a chronic quiescent stage, the ovary is often studded with numerous graafian follicle cysts and lies hidden in the coils of the adherent tube and fixed by inflammatory bands to the pelvic floor. Except for this resistance of the ovary, conservative surgery would rarely be possible.

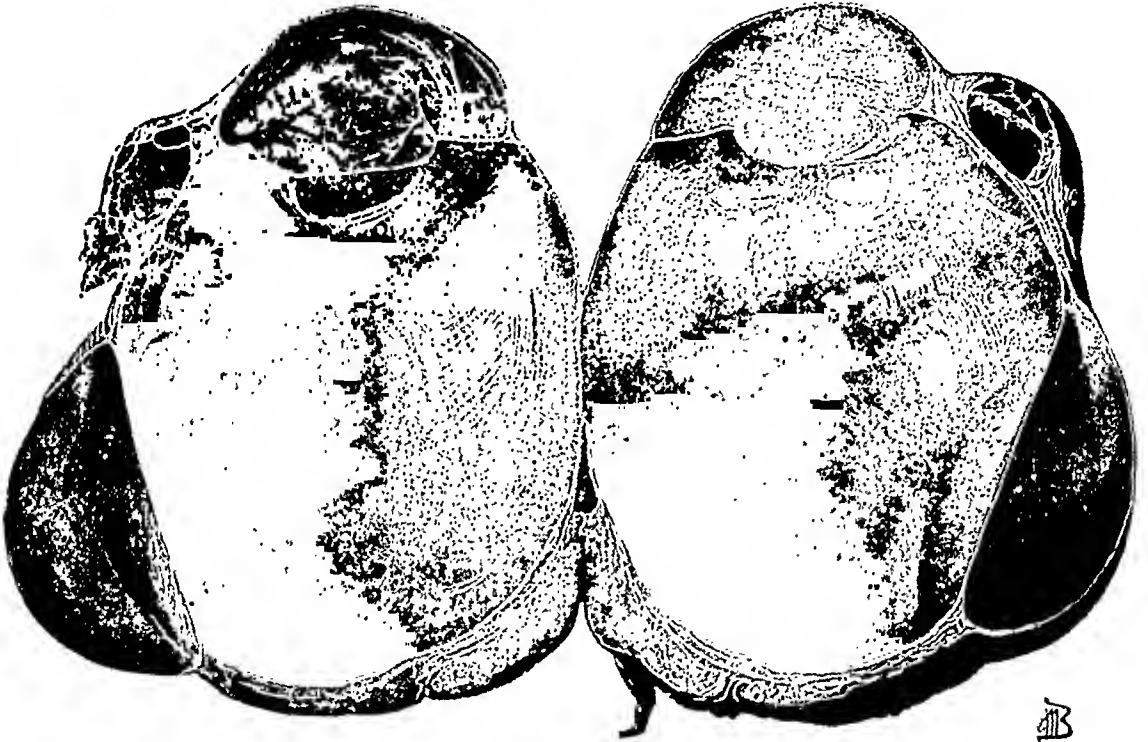


FIG. 536.—TUBO-OVARIAN CYST.

Showing opening between hydrosalpinx and graafian follicle cyst of ovary, demonstrating usual mode of origin of these communicating lesions. Remains of tubal epithelial tufts seen in delicate, attenuated bands which form fine network in tubal lumen. Remaining part of ovary lies flattened over inferior surface of cyst.

Peritoneum.—A localized pelvic peritonitis is almost invariable in an acute salpingitis and usually subsides with it. A general peritonitis is rare, but is commoner in the chronic stage when it may be due to the colon bacillus or the streptococcus.

Whether or not a pure gonococcal pus can produce a more or less generalized peritonitis was for a long time a moot question. In the early days, E. Bumm (1889) took the stand that the organism acted simply as an aseptic foreign body. Wertheim (1891), however, soon denied the immunity of the peritoneum on clinical and experimental evidence. The general attitude of those declaring the impossibility of infecting the peritoneum with gonococcus was that of assuming a mixed infection in the numerous serious clinical cases where it appeared to have occurred. H. Cushing (*Johns Hopkins Hosp. Bull.*,

May, 1899) has dealt with these important questions thoroughly, with a description of two instances in William Osler's service, concluding:

1. The cases presented bring for the first time convincing evidence of a diffuse general inflammation of the abdominal cavity caused by the gonococcus.

2. Extension of gonorrheal infection from the genital organs to the peritoneum may occur in the puerperal state and a similar sequel is possible during menstruation (as noted by Bumm).

3. Such ascending forms of gonorrhea ordinarily remain localized in the pelvis.

4. The peritoneum, suffering more commonly in females, is not more immune than the peri- or endo-cardium to gonococcal infection, although by reason of its relatively benign course, the disease rarely calls for surgery in the acute stages.

Extravasated pus tends to gravitate into the culdesac where it becomes walled off by intestines, omentum, and uterus forming a localized pelvic abscess. One sees occasionally an accumulation in the pouch at the posterior vaginal vault neatly shut off above by the cohesion of rectum and uterosacral ligaments.

GONORRHEA IN CHILDREN

Gonorrhea in infants and young girls differs so widely from that in adults as to constitute an almost distinct entity, notably in the pathology, contagiousness, and clinical course.

Pathology.—In infants and girls who have not reached the menarche, the gonorrheal lesions are almost exclusively limited to vulva, urethra, vagina, and cervix. Inguinal adenitis and condylomata are also uncommon. While the extremely delicate vaginal mucosa offers almost no resistance, the relative immunity of the internal genitalia is probably due to the absence of menstruation.

Striking pathological differences have induced some observers to classify the infantile vulvovaginitis and ophthalmia neonatorum and the salpingitis of adults as due to different strains of the organism. Because of the frequency and facility with which children contract vaginitis and ophthalmia from adults, all forms of the disease must for practical ends be held highly communicable.

Contagion.—It is so highly contagious in little girls that in hospitals vaginal smears are examined as a routine procedure before the children are admitted to the open wards; before such precautions, gonorrheal vaginitis was a commonplace hospital endemic.

The infection is contracted by the deposition of the organisms on the external genitalia, most frequently by contaminated fingers, lavatories, linen, and rape. It is rare among well-protected children of the educated class, but

so common among the poor and careless that special clinics have been provided from time to time.

Clinical Course.—A purulent vaginal discharge, irritation and pain of the external genitalia, burning, and frequent wetting vary in intensity, and are at times accompanied by malaise and fever. The yellow vaginal discharge is occasionally profuse enough to bathe the external genitals. The hymen, urethra, vaginal mucosa, and cervix are red, swollen, and sensitive. When acute, the diagnosis is easy, as the gonococci abound in the discharges. In the subsequent chronic phase, the constant symptom is an intractable leukorrhea, vaginal or cervical, persisting for months or years. In this stage, the organisms are difficult to find.

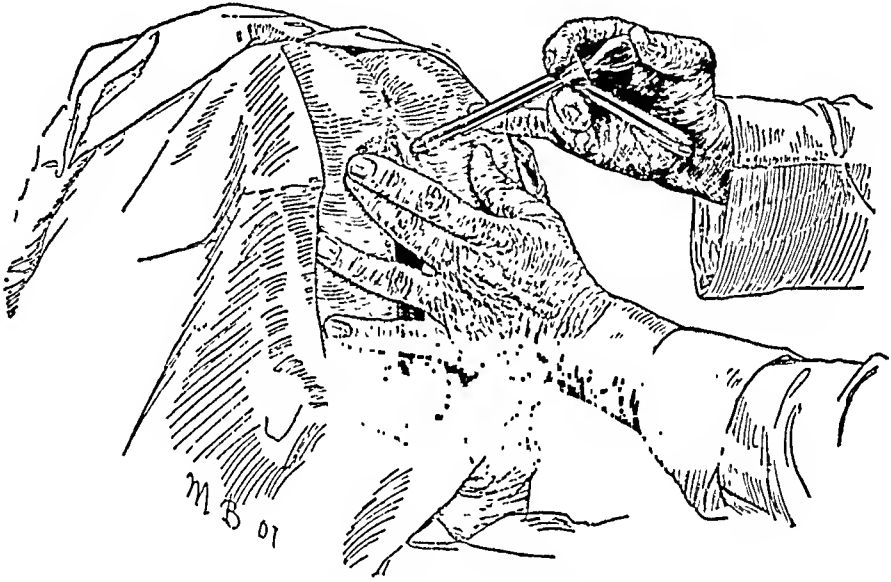


FIG. 537.—GONORRHEAL VAGINITIS IN CHILDREN.

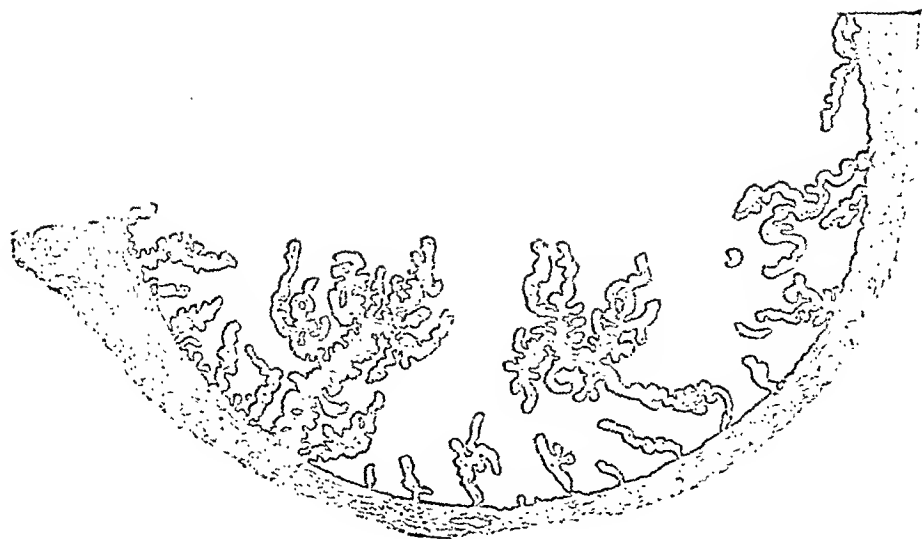
Kelly cystoscope useful in exposing vagina and cervix in young girls. Hymen not injured.

Occasionally, a gonorrheal arthritis develops from a primary vulvovaginitis, which sometimes disappears rapidly upon clearing up the primary infection.

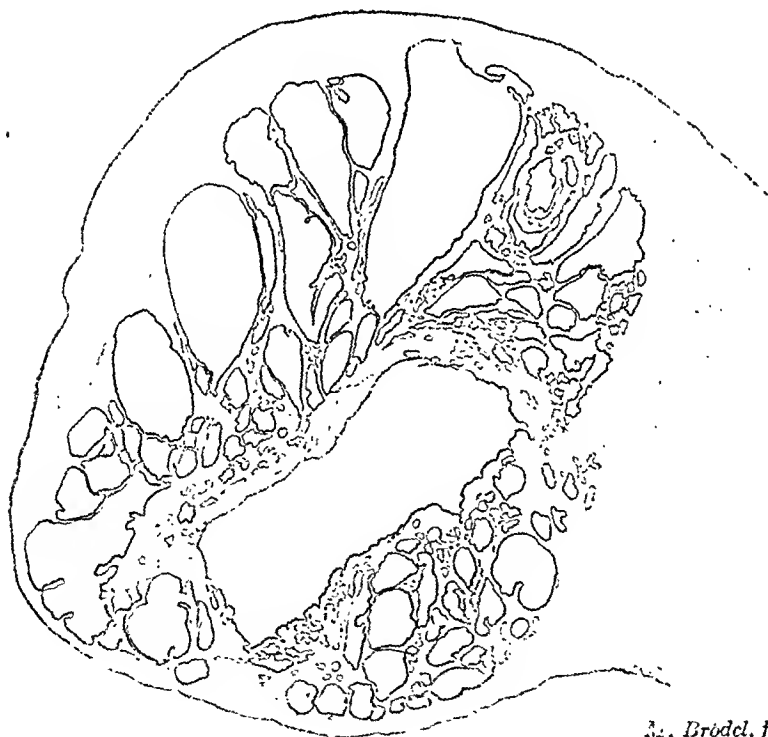
For safety's sake, vulvovaginitis and cervicitis in infants and young girls must at first be considered gonorrheal until thoroughly investigated. In the Johns Hopkins dispensary, E. H. Hurdon was able to find gonococci in 63 per cent. At times, vaginitis is due to masturbation, the introduction of a foreign body, and occasionally a nonspecific infection.

Treatment.—Great patience is the keystone of the arch. The young are often fearful and utterly uncoöperative, resisting every instrumental or other contact, and, once hurt, ever after scream and give battle when approached. The first effort must always be to gain their confidence and assent; doctors vary greatly in their talents on this head. As in adults, precautions must be taken to protect other members of the family and playmates. Ophthalmia is the constant bugbear.

Local treatment consists, first of all, in cleanliness, and then in vaginal



A



M. Brödel, fec.

B

PLATE IV.—A. HYDROSALPINX SIMPLEX.

Cross section through median portion of tube: wall attenuated by pressure. Epithelial tufts atrophic, thin, and short. Epithelium flattened. $\times 16$.

B. HYDROSALPINX FOLLICULARIS.

Cross section at junction of middle and outer third of tube. Epithelial tufts mutually adherent, changing tubal lumen into multilocular cyst. Connective tissue within epithelial tufts at times increased in amount and edematous, making tube much more dense than normal $\times 8$.



irrigations and topical applications. The vaginal irrigations are given through a soft rubber catheter. Weak solutions should be used at first and the strength gradually increased as tolerance is established. Potassium permanganate 1:8,000, bichlorid of mercury 1:10,000, or boric acid, 2 per cent, are the best remedies. Topical treatments can be given in chronic cases with the utmost

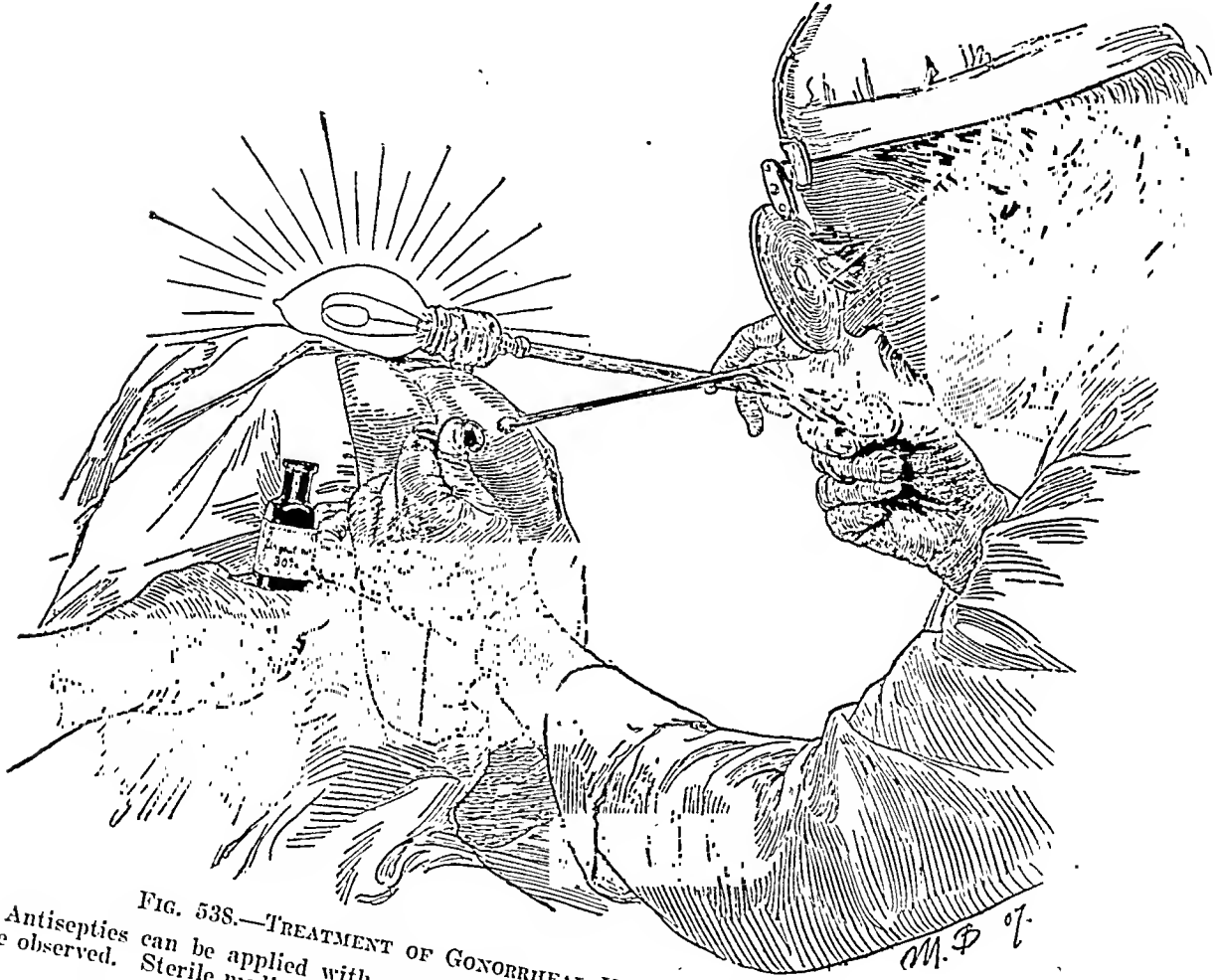


FIG. 538.—TREATMENT OF GONORRHEAL VAGINITIS IN CHILDREN.

Antiseptics can be applied with an alligator forceps, smears taken, and progress of disease observed. Sterile medicine dropper can be used to instil antiseptic solutions.

accuracy through a Kelly cystoscope (9 or 10 mm. in diameter) with the child in the knee-chest posture when the vagina balloons out and the antiseptics can be applied under direct vision. A 3 or even 5 per cent solution of silver nitrate will start the régime, followed by weaker solutions at intervals of five to seven days, using douches in the interim. Instillations, in the knee-chest posture, are also helpful. The fluid is injected two or three times a week by a medicine dropper and a clean perineal dressing applied; protargol, argyrol. Dakin's oil, tincture of iodine, acriflavin, or silver nitrate are helpful. Striking results

have been obtained following the use of strong solutions of mercurochrome. Children vary much in their sensitiveness to the drug; some can stand a 20 per cent solution given twice a week, instilled through a small rubber catheter.

Vaccine therapy has been introduced with occasional good results; current works on serology describe the technique.

Prognosis.—The virulence of the infection, the depth of invasion of the mucous membrane and the cervix, and the chronicity determine the prognosis. One should not extend a hope of a cure under six months; some resist even for years.

It is also hard to say when the disease is gone, as a discharge may continue long after the gonococci can be found and recrudescences are frequent. As in an adult, an infantile and juvenile gonorrhea is desperately resistant, chronic, and insidious; a prognosis must, therefore, be guarded.

GONORRHEAL SALPINGITIS

A gonorrheal salpingitis may develop without local symptoms, and large inflammatory masses form without significant pain, but even so its course is usually attended by leukorrhea, dysmenorrhea, menorrhagia, some dysuria, backache, vague pelvic discomforts, and sterility.

ACUTE STAGE

An indeterminate period from days to years may pass after the initial vulvovaginitis, cervicitis, or urethritis before a salpingitis appears, either indicative of latency or of a reinfection.

Symptomatology.—The acute symptoms are a sharp pelvic peritonitis with much lower abdominal pain, backache, loss of appetite, nausea, vomiting, moderate prostration, rapid pulse, chilly sensations, fever, burning on micturition, pain on defecation, and leukorrhea. The whole lower abdomen becomes tender with a maximum intensity deep in the pelvis. Muscle spasm and rigidity are less striking than in acute appendicitis. Bimanually, the pelvis is hot and exquisitely sensitive, but masses may not be detected if the infection is recent or if rigidity and tenderness excite resistance. These symptoms last from ten to fourteen days.

Diagnosis.—Although the diagnosis is usually obvious, it may be at times indistinguishable from an acute appendix, extra-uterine pregnancy, or an ovarian cyst with torsion. It is more important to differentiate an acute appendicitis where speedy intervention is likely to be urgent. When the right tube is chiefly involved, the differentiation is more difficult. As a rule, in appendicitis, the abdominal pain, as noted a hundred years ago, is at first epigastric or general, eventually localizing at McBurney's point; the nausea and vomiting are more marked; bladder symptoms are less prominent; and signs of local inflammation, tenderness, rigidity, and muscle spasm are

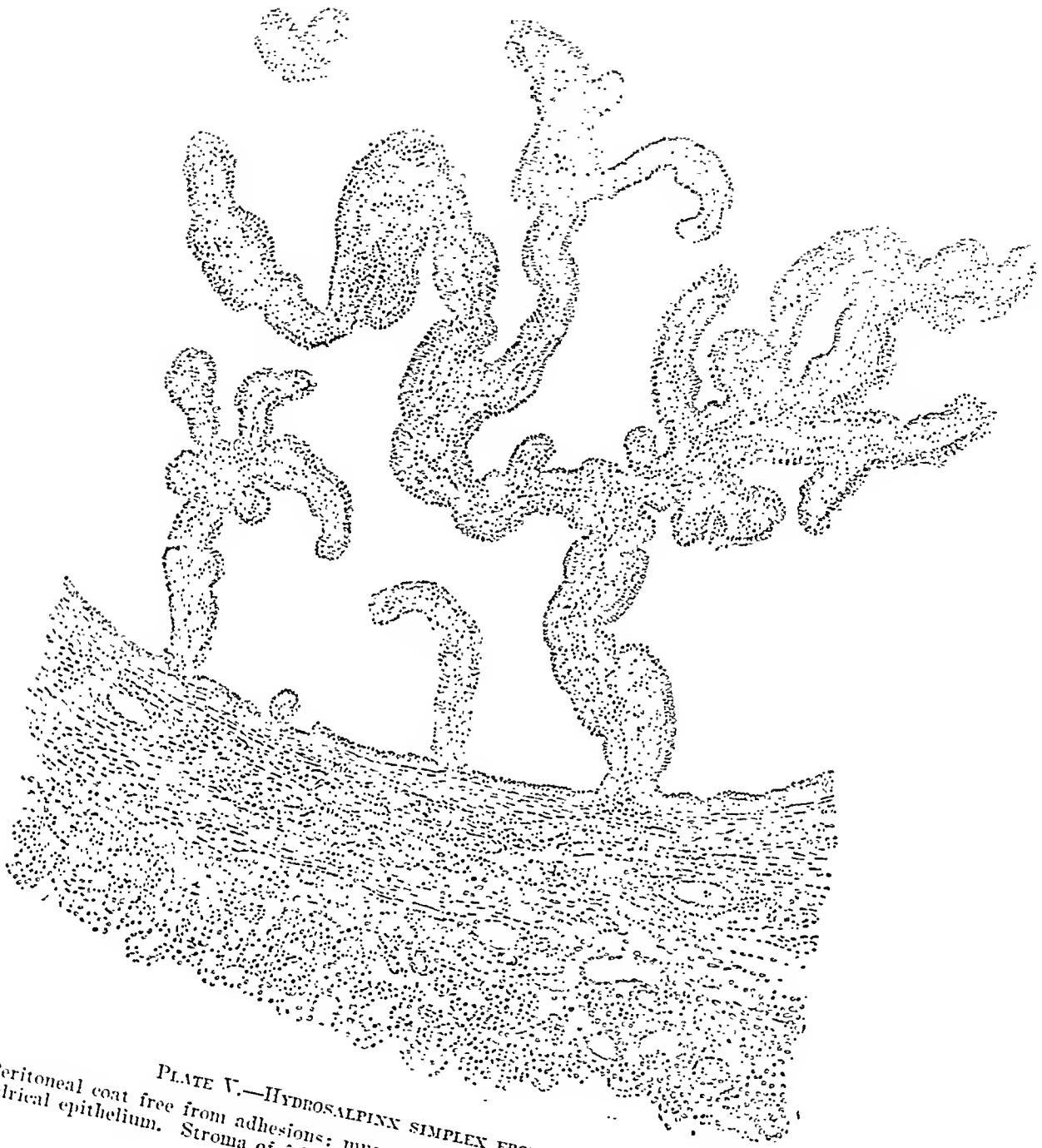


PLATE V.—HYDROSALPINX SIMPLEX FROM PLATE IV. *M. Brödel, fec.*
Peritoneal coat free from adhesions; muscularis normal. Tube lined by a single layer of
cylindrical epithelium. Stroma of folds normal. $\times 70$.

well-defined in the right iliac fossa rather than in the pelvis. Unless the appendix lies in the pelvis or has perforated, the pelvic floor and the culdesac of Douglas, as felt through the rectum or vagina, are not as tender as the right iliac fossa. In a virgin, gonorrhea can be eliminated; the presence of leukorrhea, palpable Bartholin's glands, or the demonstration of gonococci in the vaginal secretions are evidences for salpingitis. It should not be forgotten, however, that acute appendicitis and periappendicitis may occur during an acute salpingitis. When the differential diagnosis is not positive, it is wiser to operate, for in acute appendicitis an early operation may be imperative and vital.

Treatment.—The treatment is purely medical and consists in rest in bed preferably in Fowler's position, ice-caps to the lower abdomen, copious hot vaginal douches, regulation of the intestinal tract and sedatives, almost invariably followed by a symptomatic recovery within two weeks.

Some treat an acute salpingitis as they would an acute appendicitis, operating at the earliest moment, and argue that an early salpingectomy prevents late chronic sequelæ with surgical intervention and cuts short a prolonged illness. Against such a radical practice, these objections are urged:

1. An acute gonorrheal salpingitis almost never ends fatally.
2. Symptomatic recovery is almost invariable.
3. The functional integrity of the tube is not always destroyed by the disease, as pregnancy may follow.
4. Operations performed on the acutely inflamed pelvic organs and peritoneum are accompanied by much bleeding from many points and provocative of adhesions.
5. Plastic procedures necessary to obliterate raw areas are impossible.
6. Corrective procedures, such as the suspension of the retroverted uterus, are ill-advised at such time in the presence of acute purulent infection.
7. Conservation, particularly ovarian, is difficult and attended by risk with acutely infected pelvic organs.

These and other reasons show that any radical exsective procedure during an acute salpingitis is usually ill-advised, unnecessary, and not in accord with surgical conservatism; it should be resorted to where a spontaneous cure does not occur.

CHRONIC STAGE

Symptomatology.—There is usually an invalidism extending over years. While for considerable intervals the patient may feel well, she lives in the shadow of serious complications at inopportune times. Some complain only of sterility, dysmenorrhea, menorrhagia, or leukorrhea; others are more or less incapacitated.

Chronic pain in the lower abdomen with repeated acute exacerbations,

dysmenorrhea, menorrhagia, leukorrhea, pain in micturition and defecation, backache, sterility, loss of weight, general malaise, and weakness are recurring if not ever present signs. The infection is likely to be stirred up by a severe menstrual period, miscarriage, abdominal injury, exposure, or anything lowering the general or local resistance.

The statement that a chronic pelvic inflammatory disease rarely terminates fatally must be accepted with reservation. Among educated women, the risk of a fatality is negligible as they apply promptly for surgical care; when neg-



FIG. 539.—DERMOID CYSTS OF BOTH OVARIES WITH CHRONIC SALPINGITIS.

FU, Fundus uteri. Left ovary consists of numerous cysts (*D, D, D*) covered with adhesions. Left tube distended with pus. Right ovary (*D*) densely adherent, and right tube (*T*) amputated by adhesions so that it consists of three separate portions.

lected, however, as often by our colored population and the poor generally, there is a definite mortality, the usual cause of death being a general peritonitis or secondary complications such as puerperal infection, intestinal obstruction, extra-uterine pregnancy, rupture of pyosalpinx or tubo-ovarian abscess, and septicemia. The operative handicaps, also, presented by dense adhesions and purulent adnexal masses, greatly enhance the difficulties of many operations for myoma, ovarian cyst, extra-uterine pregnancy, and cancer, transforming a simple and clean surgical procedure into one of magnitude and of a higher mortality.

In advanced and neglected cases, familiar in the public dispensaries, the patient's appearance, bowed attitude and gait, with hands supporting the lower abdomen, often proclaim her ailment as she enters the room, a fact Joseph Price was wont eloquently to dwell upon. The complexion is sallow, the face lined, and there is an evident loss of weight, creating the impression of one long sick and likely to prove a poor operative risk. Such is the harvest of neglect.

During the quiescent stages, the symptoms are more in abeyance and the diagnosis rests on history and bimanual findings of sensitive and perhaps slightly enlarged and adherent tubes and ovaries.

Treatment.—There are three fundamental questions:

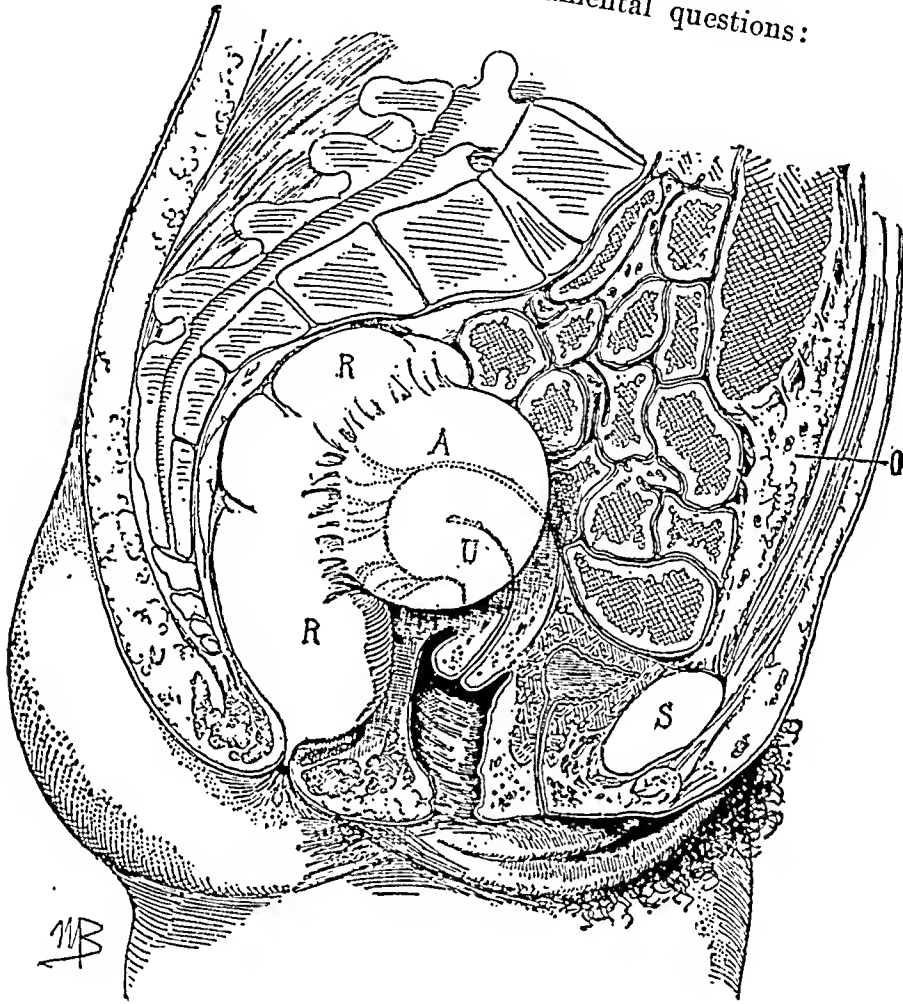


FIG. 540.—OVARIAN ABSCESS.

(A) Densely adherent to rectum, with retroflexed adherent uterus (U). General pelvic peritonitis with infection of both tubes and ovaries. Omental adhesions (O). Pus in abscess sterile. The dense, thick wall of such an abscess gives a sensation of stony hardness, often being mistaken for solid ovarian neoplasm.

1. Which cases need surgery?
2. What is the optimum time for operation?
3. Shall the surgical procedure be radical or conservative?

1. Sometimes, after the subsidence of the initial acute attack, no further treatment is required as the infection disappears completely, albeit leaving definite scars, pelvic adhesions, cystic ovaries, and closed fallopian tubes. Such lesions call for treatment only when they produce marked symptoms. If the pelvic lesions are not threatening, palliative treatments are in order—rest at

the menstrual periods, regular alvine evacuations, hot saline vaginal douches, a midday hour of rest, and ten hours at night, with instructions to report promptly if any new symptoms arise.

If the disease becomes active, and there are recurring attacks of pelvic inflammation undermining the health, surgical intervention is advisable. If a person earning her living is hampered or begins to develop arthritic troubles, it becomes imperative to remove the probable *fons et origo mali*. Conservatism is out of place in a woman who has a long history of semi-invalidism or in a woman up in her forties. In looking for foci of secondary infections we must not neglect the pelvic organs, the cervix, the uterus, and the tubes.

2. The optimum time for surgical intervention is in an improved physical condition with temperature normal and inflammation quiescent. It is rarely necessary to operate during an acute stage or exacerbation, unless complications, such as a well-defined pelvic abscess, general peritonitis, or a beginning intestinal obstruction, arise.

3. The operative treatment should be conservative when possible and radical when necessary. The restoration of health is the paramount aim; the preservation of the menstrual and ovarian functions is a secondary consideration, but one always to be borne in mind. Since both fallopian tubes are usually diseased and in the majority of cases require removal, conservatism affects chiefly ovaries and uterus.

Speaking broadly, tubal conservatism in the face of well-defined disease is a mistake. When, however, a tube looks fairly normal and its patency can readily be restored by a plastic operation, the temptation to preserve it is great, particularly if its sacrifice means sterility in a young woman extremely anxious for a child. Before reaching such a decision, the tube should be palpated carefully throughout its length, with especial attention to any thickened nodes or induration more likely to be found in its isthmal and interstitial portions—signs of an obstructive inflammation curable only by ablation. Milking a tube sometimes unexpectedly brings a few drops of pus out on to the fimbriæ. If the tube appears normal and conservatism is urgent, one may try to save it by dropping it to the pelvic floor near a vaginal drain. The patency of the lumen is best determined not by a probe but by forcing air into the uterus through the abdominal ostium. When both tubes are occluded and therefore functionless, a bilateral salpingectomy is demanded.

The risk sometimes involved in tubal conservatism does not apply to ovaries and uterus, as these organs are rarely hopelessly diseased. Since the ovarian function is involved in metabolism and the sexual impulses, every reasonable effort should be made to preserve them. Women also regard menstruation, during the normal reproductive period, as one of the insignia of sex, and its regular function has, therefore, a psychic as well as physical value.

Ovarian and uterine conservation are increasingly consequential in the young and even a fragment of an ovary may prevent a premature menopause.

In older women we should be more radical, but even then obviously normal ovaries should not be removed unless seriously involved in the inflammatory nexus.

When bilateral salpingo-oöphorectomy is unavoidable, hysterectomy becomes a matter of surgical expediency, as without the ovaries the uterus is functionless and sometimes troublesome, and its removal with the lateral structures leaves a far cleaner pelvis.

Conservative surgery demands greater skill and judgment and is attended

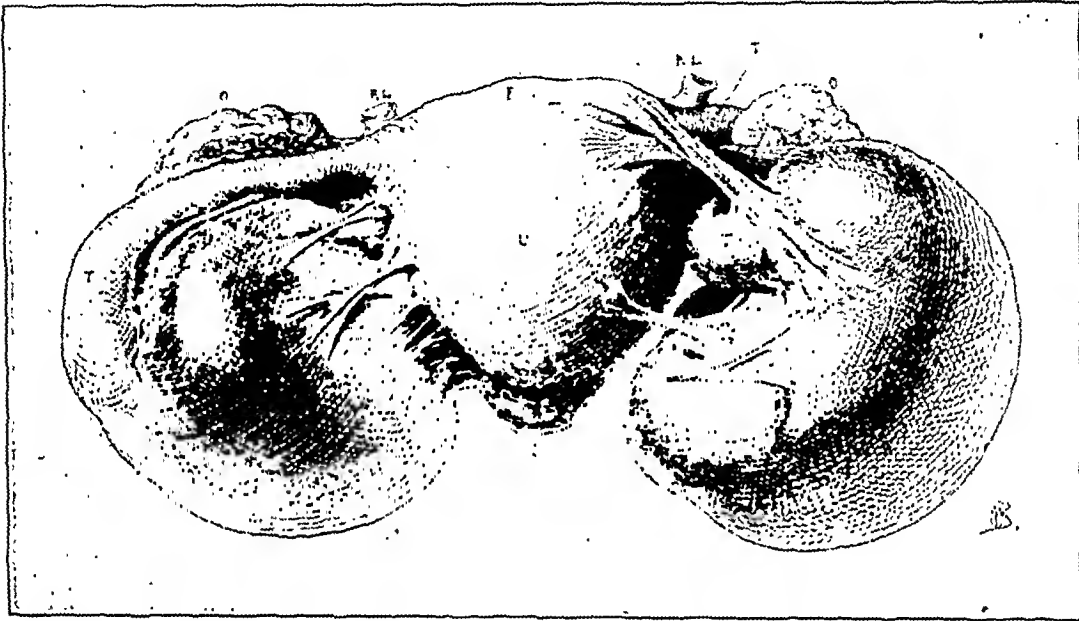


FIG. 541.—HYSTEOSALPINGO-OÖPHORECTOMY FOR LARGE BILATERAL HYDROSALPINX WITH EXTENSIVE ADHESIONS.

by greater risk than a radical extirpation. Its rewards, however, when successful are proportionately greater and worth striving for. It is a cardinal principle that organs should only be saved when the blood supply is adequate and they are left in normal vascular relations.

A good exposure of the field through a generous abdominal incision with a well-elevated pelvis is a prime requisite. After the adhesions binding the omentum and intestines to the pelvic organs have been deliberately and painstakingly separated under sight and touch, these viscera are displaced into the upper abdomen and held there by moist gauze pads, leaving the pelvis perfectly exposed.

The uterus and the lateral masses are now located. By a blunt finger dissection the uterine body is liberated and grasped with the large, smooth elevator and drawn toward the symphysis. The sharp-toothed musean clamp can be used if the fundus is covered with a rather thick gauze pad to prevent laceration and slipping. The lateral structures are liberated with care, using the fingers as blunt dissectors, each one with an eye in the end, distinguishing the quality

of the adhesions binding organs to abdominal walls and pelvic floor, and recognizing readily when to advance and when to start afresh at another point. The most favorable place to begin the separation is along the posterior uterine wall and the medial pelvic floor where planes of cleavage are more readily found. Rough handling and pulling may result in tearing the rectum as we

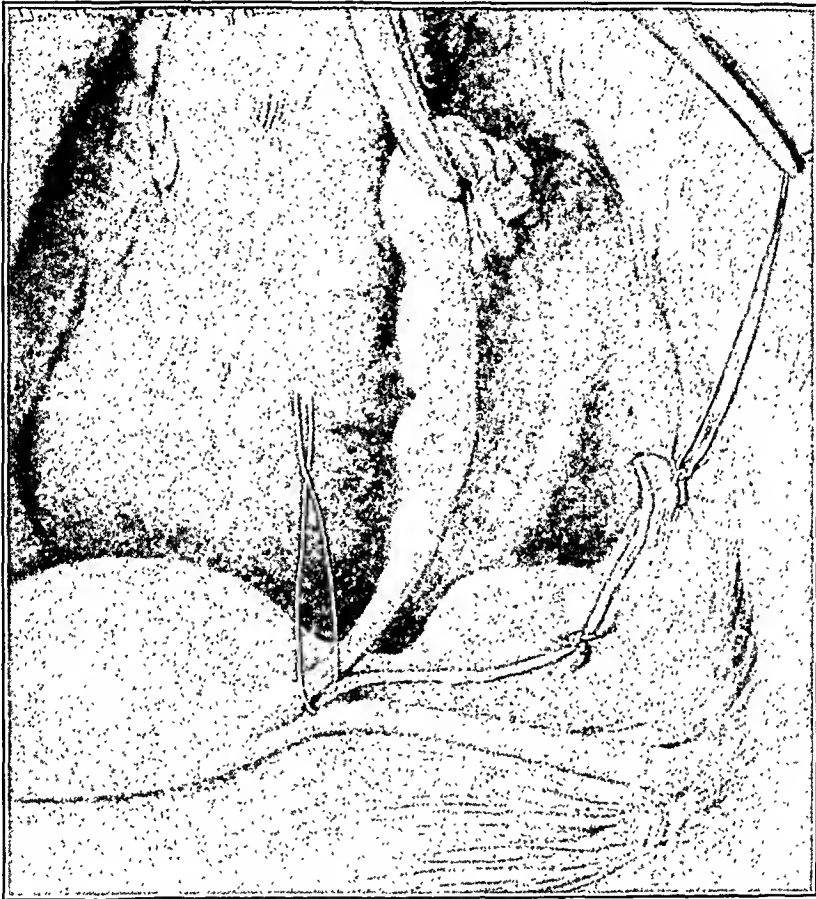


FIG. 542.—BILATERAL SALPINGECTOMY, OVARIAN CONSERVATION, CLOSING RAW AREAS, SUSPENSION OF UTERUS. FIRST STEP.

Blood supply of ovary avoided. (C. C. Norris, *Gonorrhea in Women*, W. B. Saunders Co.)

so often did in the early days, and in the rupture of tubal or ovarian abscesses otherwise easily removed intact with care. An abscess likely to rupture is often best emptied by a suction apparatus and then enveloped in gauze to absorb any oozing discharges. When the lateral masses are at times so firmly fixed that the enucleation promises to be long and difficult and not without risk, a bisection of the uterus quickly leads down to the bases of the broad ligaments and the uterine vessels which are thus controlled before any other vessels and first one and then the other half of the uterus removed. Details are presented in Chapter XXIV. After bisection, the lateral masses are much more easily taken out under the advantages of a perfect exposure and abundant room affording a larger arena.

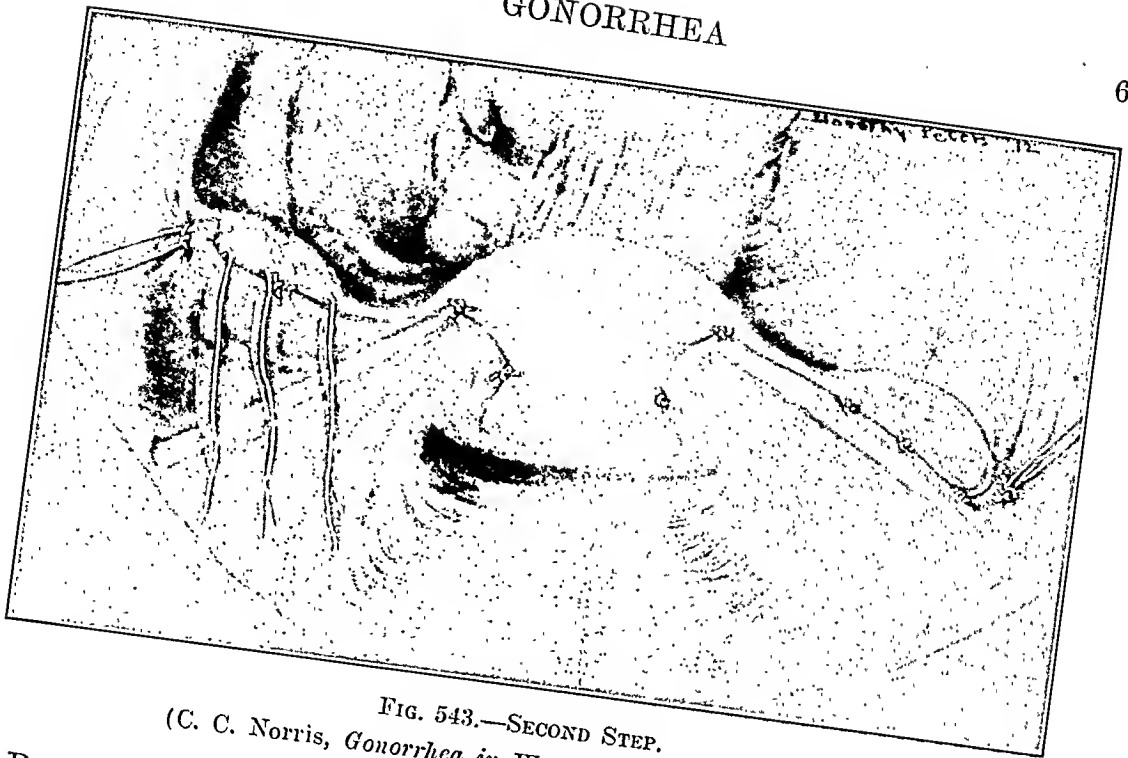


FIG. 543.—SECOND STEP.
(C. C. Norris, *Gonorrhea in Women*, W. B. Saunders Co.)

Returning to the question of conservatism, after the lateral masses and the uterus are loosened up, a careful examination is made to determine the extent of the disease, and the pros and cons of conservatism. The alternatives

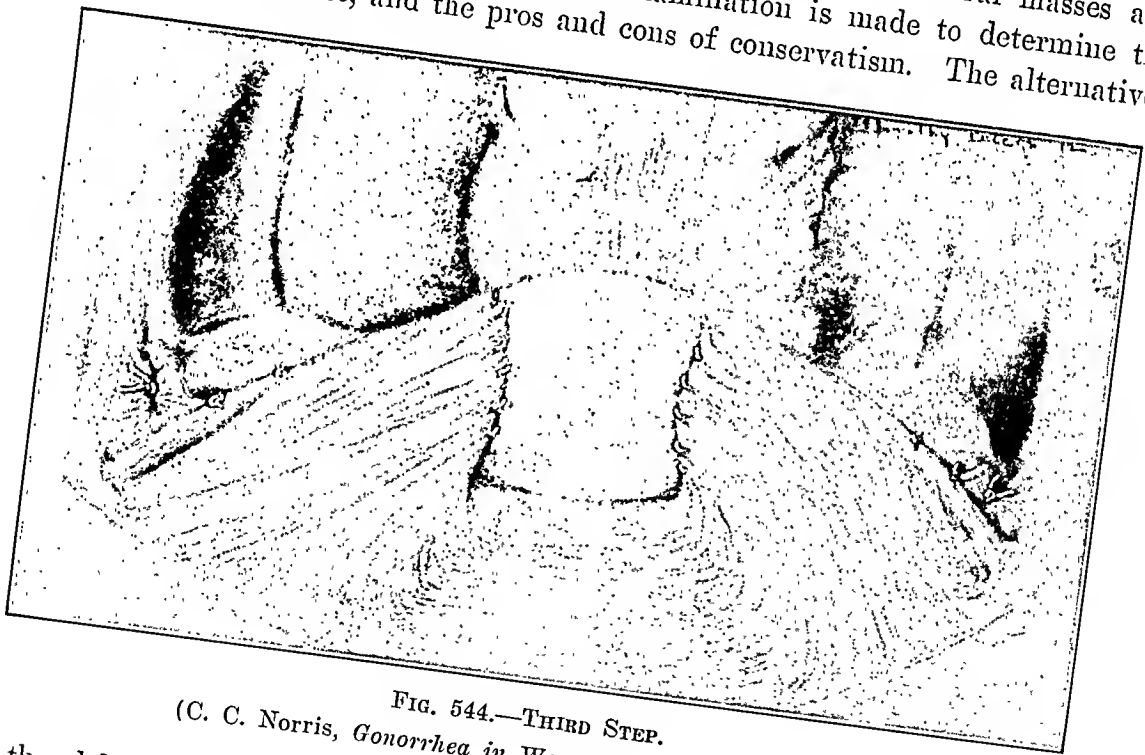


FIG. 544.—THIRD STEP.
(C. C. Norris, *Gonorrhea in Women*, W. B. Saunders Co.)

in the abdominal operation are: Removal of but one affected tube; removal of both affected tubes; removal of one tube or both tubes and one ovary; removal of one tube and the opposite ovary; removal of uterus with both tubes, leaving

one or both ovaries. If both tubes are removed, the uterus functions normally, except as to pregnancy. With one sound tube and an opposite ovary, pregnancy can occur. It is of no use but harmful to retain the uterus when both tubes and ovaries are ablated. If salpingectomy only is called for, injury of the ovarian blood supply must be avoided by skillful dissection of each tube, carefully following its under surface with scissors or acusector and catching

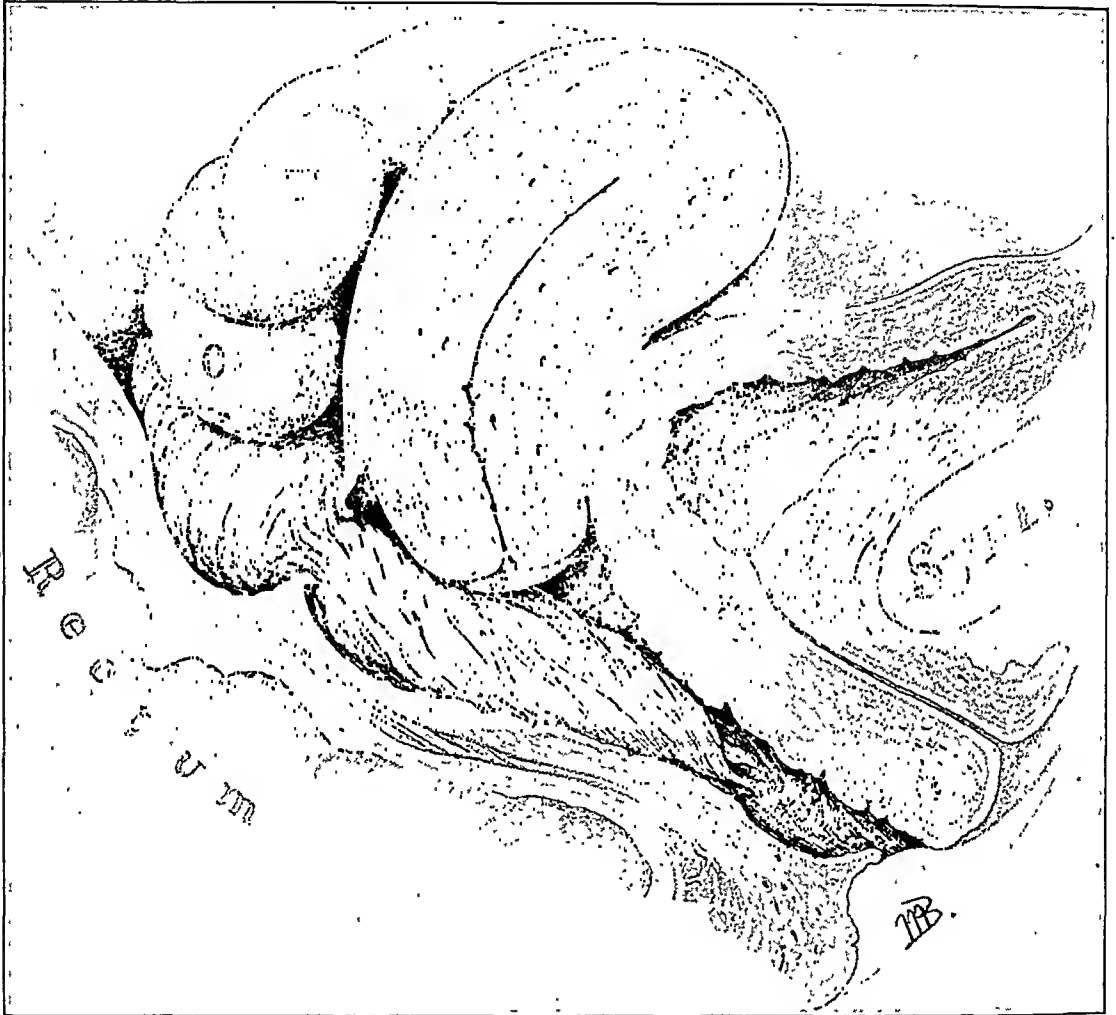


FIG. 545.—IDEAL METHOD OF DRAINING INFECTED PELVIS.

Drain passed through opening in culdesac of Douglas behind cervix.

bleeding vessels which are ligated with fine catgut or controlled by a coagulation current. A running suture then turns in the whole, bringing peritoneal surfaces together. The ovarian branch of the uterine artery leaving the uterus just under the fallopian tube should be spared. If the ovary is removed with the tube, these precautions are not necessary; then both ovary and tube are lifted up together and the pedicle transfixed and tied both ways. It is well to sew this over, turning it in under the peritoneum. In salpingectomy, it is often wise to cut into the cornu uteri and excise the interstitial part of the tube.

All raw areas must be covered by peritoneum so far as possible, and the uterus and ovaries left in a good position. The rectum and sigmoid are finally arranged to fill the pelvis and keep out the small intestines. As a means of covering over the raw surfaces and supporting the uterus and ovaries, the modified Coffey suspension operation is satisfactory and simple, involving as it does the plication of the round and the adjacent leaves of the broad ligaments over the uterine cornua, concealing raw areas, and affording an excellent support to the organs.

It is usually wiser to drain when pus has been spilled or if there is a likelihood of considerable capillary oozing. An exception may be made in dealing with an old gonorrheal abscess, where it is safe to cleanse thoroughly and close without drainage. This procedure, bold and daring in its day, was inaugurated by B. F. Baer, who was wont periodically to astonish and to shock the Philadelphia Obstetrical Society in the late eighties by exhibiting "pus-tubes" he had removed with or without rupture, and challenging controversy by declaring that he never drained in any pus cases, and that in a day when drainage was almost universal, even of perfectly clean cases. 'The best drain is through the vaginal vault, which is prompt, continuous, and effective and obviates the risk of a hernia.

There is scarcely a field in operative surgery where good judgment has freer play and the results are so uniformly gratifying as in the treatment of a chronic salpingitis. The mortality is almost negligible and the relief is permanent.

CHAPTER XXXV
TUBERCULOUS SALPINGITIS
LAWRENCE R. WHARTON

PATHOLOGY

Fallopian Tubes and Peritoneum

Uterus

Ovary

Cervix

Vagina

Vulvovaginal Glands

AGE

SYMPTOMATOLOGY

Abdominal Pain

Fever

Gastro-intestinal Disorders

Menstrual Disturbances

Urinary Disturbances

Leukorrhea

Loss of Weight

Backache

Sterility

EXAMINATION

DIAGNOSIS

TREATMENT

General

Surgical

RESULTS

Before Hegar's monograph in 1886, tuberculosis of the reproductive organs was considered rare enough to be negligible; since, many phases of this protean disease have been laid bare and knowledge increased and systematized. It resolves itself, with few exceptions, into the study of tuberculous salpingitis.¹

¹ Hermann Bruenig, *Tuberkulose der weiblichen Geschlechtsorgane im Kindesalter*; Alfred Labhard, "Beiträge zur Genital- und Peritoneal-Tuberkulose," *Ztschr. f. Geburtsh. u. Gynäk.*, 1912, 70; Charles C. Norris, *Gynecological and Obstetrical Tuberculosis*, 1921; M. Simmonds, "Ueber Tuberkulose des weiblichen Genitalapparates," *Arch. f. Gynäk.*, 1909, 88.

One in every thirteen inflammatory tubes removed in the Johns Hopkins Hospital has been tuberculous (*Johns Hopkins Hosp. Rep.*, 1893, 3).

Pathology.—Tuberculosis is due to the invasion of the *Bacillus tuberculosis*, the lesion being characterized by a chronic inflammation, destruction of tissue, connective-tissue proliferation, caseation, and the formation of giant-cells and tubercles.

Fallopian Tubes and Peritoneum.—On the operating table, tuberculous salpingitis differs from other pelvic infections by the little glistening tubercles peppered over the pelvic organs and the adjacent peritoneum and often disseminated over the intestines and the abdominal walls, when it is frequently accompanied by free fluid in the peritoneum and nodular caseous omental

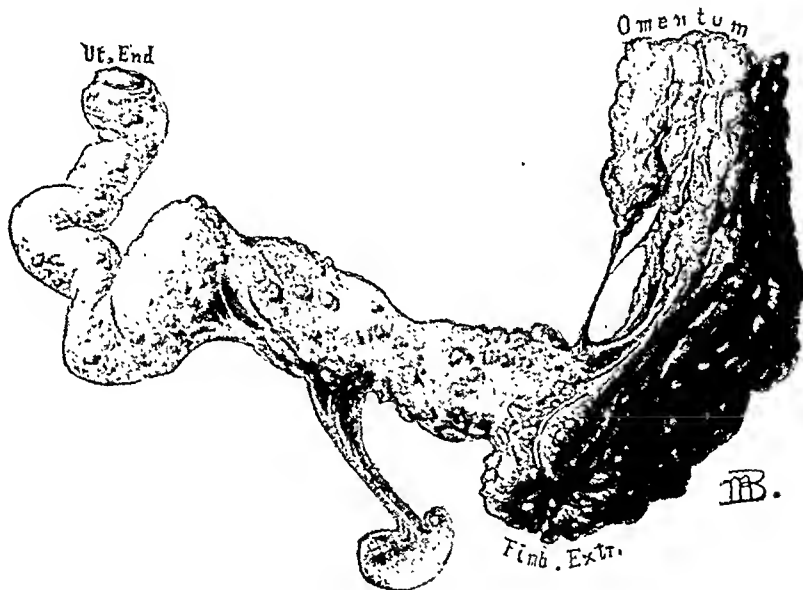


FIG. 546.—TUBERCULOUS LEFT TUBE WITH ADHERENT OMENTUM. $\times 1$.

masses, as well as an enlargement and caseation of pelvic and mesenteric glands. The diagnosis may be obvious at a glance, or the lesions may show none of the earmarks of a tuberculous process and the diagnosis is only discoverable after careful microscopic study.

In tuberculosis as in gonorrhea, the fallopian tubes are involved whenever the internal reproductive organs are affected. In two hundred in the Johns Hopkins Hospital, there were but two with nontuberculous tubes; both tubes usually participate (99 per cent). In this series, the uterus was tuberculous in 72.6 per cent, ovaries in 33 per cent, cervix in 3.5 per cent, and the vagina but once, in 0.5 per cent. In 68 per cent, there was coincident tuberculous peritonitis, in 3 per cent tuberculous appendix, and in 2 per cent an associated tuberculosis of the urinary tract. In these citations we rely upon the work of J. P. Greenberg (*Johns Hopkins Hosp. Rep.*, 1921, 21).

The *fons et origo* of pelvic or peritoneal tuberculosis is commonly a primary pulmonary localization. In 3,514 necropsies on females, Hans Schlimpert of

Dresden ("Die Tuberkulose bei der Frau, etc.," *Arch. f. Gynæk.*, 1914, 94) found gross tuberculous lesions in 2,173 (61 per cent), with a relative anatomical frequency as follows: lungs, 84.3 per cent; intestine, 32.3 per cent; peritoneum, 4.9 per cent; genital organs, 3.4 per cent; meninges, 3.3 per cent; bones, 2.5 per cent; pericardium, 2.2 per cent; urinary trace, 1.4 per cent. Such data make it clear that tuberculosis in the pelvis is a local manifestation of a systemic affection and point to the methods of treatment necessary for success, which must consider the entire organism and ever recognize the primary importance of the original focal zone.

A tuberculous tube varies in appearance with the stage of the disease. Early, it is red, edematous, and inflamed, and its surface is studded with fine miliary tubercles while the fimbriated extremity may be flaring, trumpet-shaped, and open. There may be free fluid, but without dense adhesions, caseous masses, or abscesses. The tubes and ovaries may be free or lightly adherent. Such a process may subside, leaving only the healed tubercles and a few adhesions to betray the recent activity. Later, the tubal epithelium is destroyed, the fimbria closed, and the tube filled with a purulent exudate which forms an abscess sac, often embracing and at times imbedding the ovary and ending in the familiar typical tuberculous pyosalpinx or tubo-ovarian abscess. The organs become densely adherent to neighboring structures and form rigid, irregular, tender, fixed pelvic masses; the excessive peritoneal fluid is gradually absorbed. In this chronic adhesive or fibroplastic stage, the process may remain quiescent indefinitely.

Another form is the massive or nodular variety characterized by abdominal masses, at times consisting of loops of indurated tuberculous intestine adherent mutually or to the pelvic viscera and occasionally assuming bizarre appearance. We recall the attempt of a competent operator to remove such a mass for an ectopic kidney! Caseation and necrosis, a part of the tuberculous process, may cause perforation of the visceral walls and end in localized intra-abdominal abscesses, general peritonitis, fistulas, or sinuses. A tuberculous pyosalpinx adherent to bladder, rectum, or small intestine, opening into one or more of these organs, presents a serious surgical problem. Again, a pyosalpinx may rupture into the pelvis to form a pelvic abscess which discharges into vagina or rectum. The opening is usually small, a sort of safety valve, while the abscess becomes walled off above.

In an advanced stage, the mesenteric lymph glands are enormously enlarged and caseous, forming irregular, hard abdominal tumors, and the omentum is thickened and indurated in a palpable transverse mass in the region of the umbilicus.

Two-thirds of our patients with tuberculous salpingitis had tuberculous peritonitis. In some peritoneal cases, the tubes remain normal, while in others the tubal lesion is clearly the primary focus.

Uterus.—Intra-uterine tuberculosis is one of the rare causes of a chronic

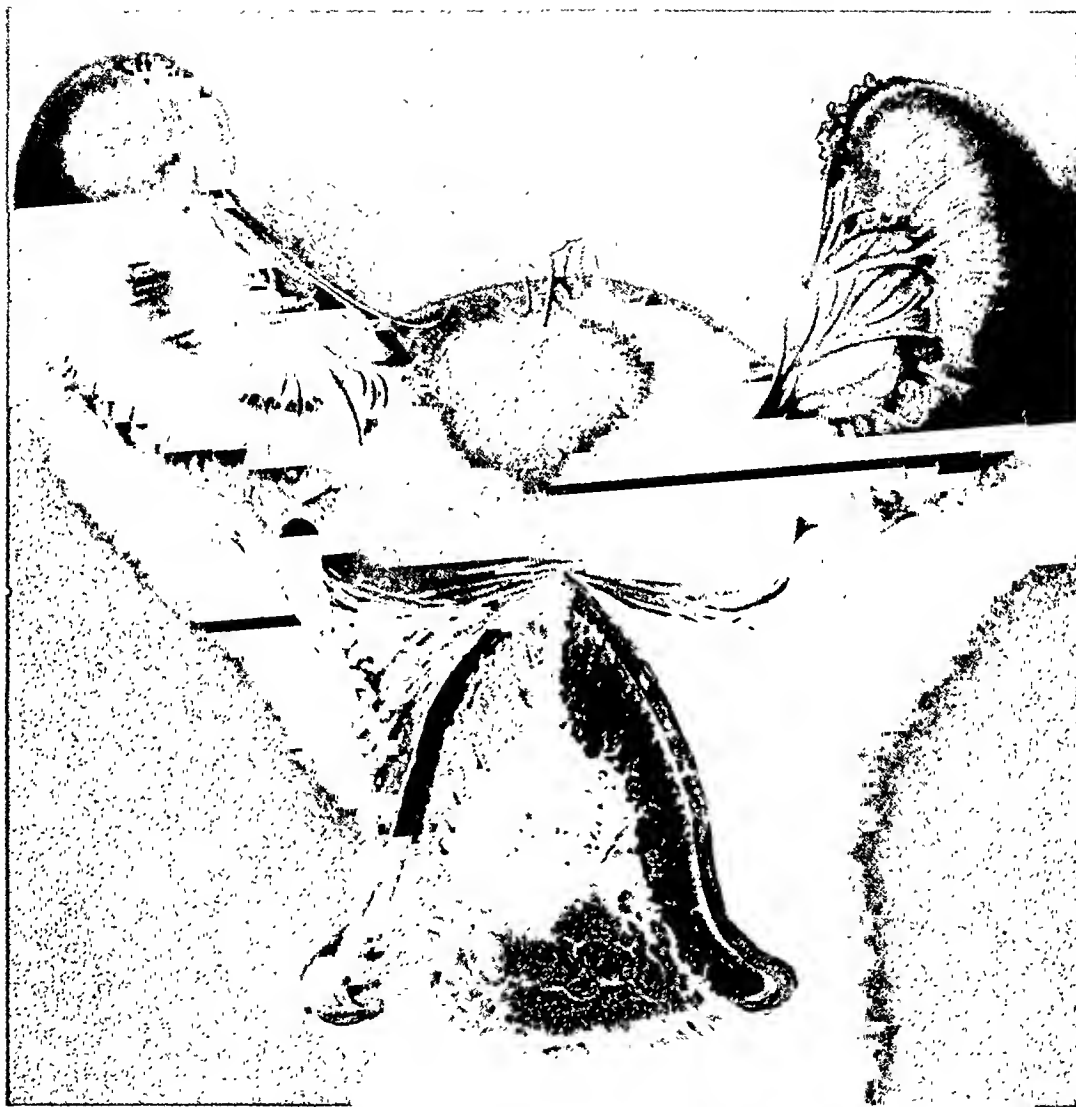


PLATE VI.—TUBERCULOUS UTERUS AND TUBES.

Destructive endometritis. All glandular tissue replaced by caseation and granulation tissue. Marked injection of uterine wall. Bilateral pyosalpinx with adhesions. $\times 1$.

endometritis. The lesion is almost always sharply limited to the body, stopping at the internal os and not involving the cervix. With the endometritis, there is often an extension into the muscle—a myometritis, the endometrium being destroyed at times, the menstrual function lost, and the uterine cavity filled with the thick, purulent, caseous fluid (pyometra).

Such a localization of a tuberculosis is not often seen, for in three-fourths of our list uterine and tubal disease were coexistent.



FIG. 547.—TUBERCULOUS ENDOMETRIUM.

Showing scattered uterine glands with heavy round-cell infiltration of stroma and tubercles with giant-cells. (J. H. U. Gyn.) $\times 150$.

Ovary.—Tuberculosis of the ovary occurs with about one-third of the involved tubes. Rare cases have been seen with a normal tube and an ovary infected through a ruptured graafian follicle or corpus luteum in contact with a tuberculous appendix or intestine.

Cervix.—The cervix is affected in but 3 or 4 per cent of the pelvic tuberculoses. The lesion assumes either an ulcerative or a hypertrophic form; in the former, it becomes deeply excavated and covered by a superficial layer of granulation tissue, and in the latter, the granulations are excessive, at times polypoid, and form an exuberant growth which bleeds at touch. This is easily

mistaken for carcinoma of the cervix, but the granulations are tougher and less friable; under the microscope, which should be used in every instance, the diagnosis is clarified. (L. R. Wharton, "Rare Tumors of the Cervix of the Uterus of Inflammatory Origin—Condyloma and Granuloma," *Surg., Gynec., & Obst.*, Aug., 1921).

Vagina.—Tuberculosis of the vagina is even rarer than of the cervix; not over fifty or sixty cases are reported. We have seen two in the Johns Hopkins

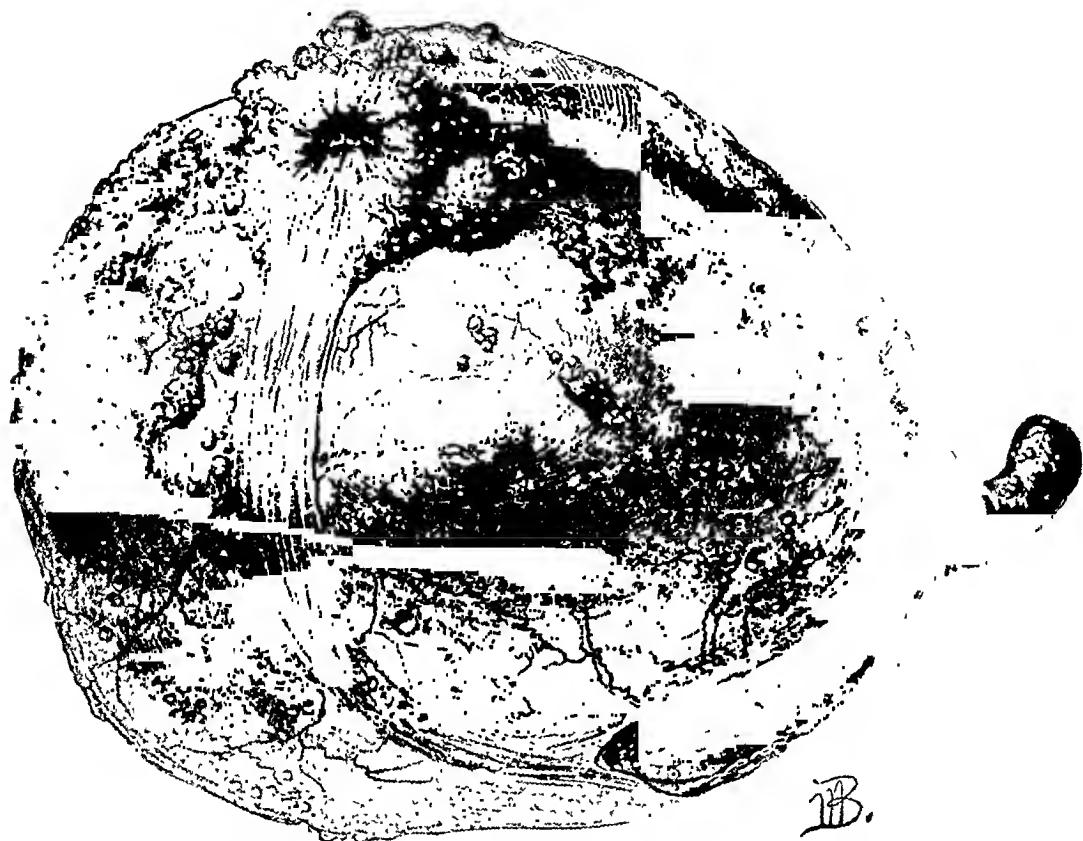


FIG. 548.—TUBERCULOUS RIGHT TUBE WITH TUBERCLES SCATTERED OVER A PAROVARIAN CYST. $\times 1$.

Hospital. (L. R. Wharton, "Tuberculosis of the Vagina," *J. Am. M. Ass.*, 1925, 85).

Vulvovaginal Glands.—An instance of this rare affection is reported by J. W. Gordon (*J. Am. M. Ass.*, 1925, 84). The patient married at twenty-four, had had one child, and suffered from backache, a sense of fullness in the rectum, dyspareunia, and an evident abscess of the left Bartholin's gland which presented a nodular outgrowth at the orifice and was removed, discharging a thin watery pus. Examination in the laboratory showed this to be a chronic tuberculosis, Figures 158 and 159. There was no involvement of any other organ of the body.

Age.—This may occur at all ages and has a wider age incidence than any other variety of pelvic infection. While it is the commonest cause of pelvic



FIG. 549.—TUBERCULOSIS OF TUBES AND OVARIES.
 Right tube and ovary divided, showing numerous cross-sections of tube. Convoluted pyosalpinx and ovarian abscesses.
 FU is fundus uteri; M, myoma. A case for complete extirpation. X $\frac{2}{3}$.

infections in infants and virgins, it occurs most frequently in the child-bearing period, three-fourths of our list being between twenty and forty.



FIG. 550.—SCRAPINGS FROM TUBERCULOUS CERVIX.

aa' and *bb'*, surface epithelium; *c*, fragment of cervical mucosa; *dd*, typical high cylindrical cervical epithelium; *e*, bases of cervical glands; *f*, giant-cell surrounded by *g*, zone of epithelioid cells; *g'*, *g''*, *g'''*, areas of epithelioid cells; *h*, *h'*, *h''*, many small round cells. (T. S. Cullen, *Cancer of the Uterus*, W. B. Saunders Co.) $\times 180$.

Symptomatology.—The symptoms vary remarkably. In the inactive and quiescent forms, there may be little or no discomfort; hence, many are found unexpectedly during abdominal operations for other indications.

The onset is usually insidious. At times, the earliest local symptoms occur



H. Becker, fec.

PLATE VII.—ENDOMETRIAL TUBERCULOSIS, FAIRLY EARLY.

(a) Normal uterine muscle; (b) endometrial area; (c, d, e) glands not completely destroyed, no caseation; (f, g) tuberculous granulation tissue with giant-cells replacing most of stroma; (h) intervening stroma, seat of marked small-celled infiltration; (i) blood-vessel. $\times 70$.

during a menstrual period, as a dysmenorrhea or a menorrhagia; rarely, they date from a miscarriage. In gonorrhea, on the other hand, we are apt to have a more acute onset with a history of an exposure and the prompt development of urethritis, bartholinitis, cervicitis, and, subsequently, abdominal pain; streptococcal pelvic infections have the background of a febrile puerperium. Twelve of our patients were labeled typhoid fever, two, rheumatism, and eight, malaria, before a correct diagnosis was reached.

In the full-blown disease or an active phase, the symptoms may present all grades of intensity and exhibit a close parallelism with a gonorrheal salpingitis, making it impossible to clarify the diagnosis before operation.

The most important local symptoms are abdominal pain, fever, gastrointestinal disorders, disturbed menstruation and micturition, leukorrhea, loss of weight, backache, and sterility.

Abdominal pain is an outstanding symptom of a tuberculous salpingitis, present in 90 per cent, and usually referred to

the lower abdomen but occasionally felt in the epigastrium under the costal margin or near the umbilicus. It is usually a dull ache, aggravated by exertion, and subject to exacerbations during the menses, though sometimes more of a dragging sensation and extremely sharp. Occasionally an intestinal obstruction develops as the abdominal adhesions and masses slowly form. Serious obstructive symptoms are unusual.

Fever usually occurs in the afternoon—an index of the extent and activity of the process. In about two-thirds, the afternoon temperature rises to 99.2° or higher.

Gastro-intestinal disorders are constipation (57 per cent) and sometimes an alternating constipation and diarrhea. There is pain on defecation in 25 per



FIG. 551.—TUBERCULOSIS OF ENDOMETRIUM.

Three uterine glands are seen. Typical tuberculous lesion in center of field, with three giant-cells. *a*, *b*, clusters of epithelioid cells. (T. S. Cullen, *Cancer of the Uterus*, W. B. Saunders Co.) $\times 250$.

cent; loss of appetite in about half; nausea and vomiting in about one-fourth; and complaint of enlargement of the abdomen in one-third. A coincident tuberculous enteritis is not to be overlooked.

Menstrual disturbances are dysmenorrhea, menorrhagia, irregular menstruation, scanty menstruation, and complete amenorrhea; intermenstrual bleeding is almost never found. There is usually a tendency toward scanty menstruation and amenorrhea, less frequent in other pelvic infections.

Urinary disturbances are dysuria, nocturia, and pollakuria, due to the inflammatory process in the pelvic vesical peritoneum as well as to the affected organs in contact with the bladder. Only 2 per cent had tuberculous lesions in the urinary tract.

Leukorrhea is found in practically all; *loss of weight* noted in half; *backache* is a common complaint; and 60 per cent of the married are *sterile*. We know of no instance of conception after the disease is contracted.

Examination.—The importance of a complete physical examination of every patient is admirably illustrated by tuberculous salpingitis. Clinically, the one most important problem is to discover the disease elsewhere and to estimate its extent, activity, and general significance. In 13 per cent we found pulmonary involvement, and in 16 per cent of the remainder there were presumptive evidences; thus, about one-fourth was either definitely affected or highly suspicious.

On inspection the abdomen may be distended, as noted in about one-third of our own patients, although seldom prominent, the enlargement being due to gas or to free fluid or consisting of localized knots of intestines or of inflammatory masses in the omentum or in the pelvis. Palpation generally elicits tenderness, and, if the peritoneal involvement is acute, muscle spasm.

A characteristic sign is a decided change in form in the several abdominal masses mapped out within a short period, say after ten to fourteen days. When the disease is more localized, one often finds bimannually the characteristic nodules in the isthmal portion of one or both tubes. The curettage of the endometrium, disclosing tubercles there, is decisive.

In about one-fourth, the leukocyte count was below 5,000, and in about 40 per cent it was normal, while one-third had a leukocytosis above 9,000. In acute form, the count may ascend to 22,000. Remembering that all of these patients have pelvic infections and that two-thirds have peritonitis and fever, where we expect a leukocytosis, it would seem that a normal leukocyte count should be interpreted as relative leukopenia.

Secondary anemia is common; in half the hemoglobin was less than 70 per cent.

Diagnosis.—As a rule, tuberculous salpingitis is difficult to diagnose. In the first place, the disease is infrequent; secondly, in a number of instances it is not even recognizable when under direct vision; and third, associated pelvic lesions often obscure the picture.

In typical cases, however, the clinical picture is clear. The classical case, often quoted but rarely seen, is that of an infant or virgin with an outspoken pelvic infection. The suggestive clinical picture is that of a chronic pelvic infection of insidious onset, with persistent and at times marked gastrointestinal symptoms, low fever, and signs of chronic peritonitis; if we add to this, free fluid in the abdomen with pelvic and abdominal masses more or less dense and fixed and relative or absolute leukopenia, it becomes still clearer. In a virgin with a tuberculous family history and with tuberculosis elsewhere, the diagnosis becomes assured. Intra-abdominal tumors varying in size and location on successive examinations at intervals of two or three weeks are apt to be tuberculous. If there is a vaginal fluor and the uterus is curetted, a tuberculous endometrium points with no uncertain fingers to the diagnosis.

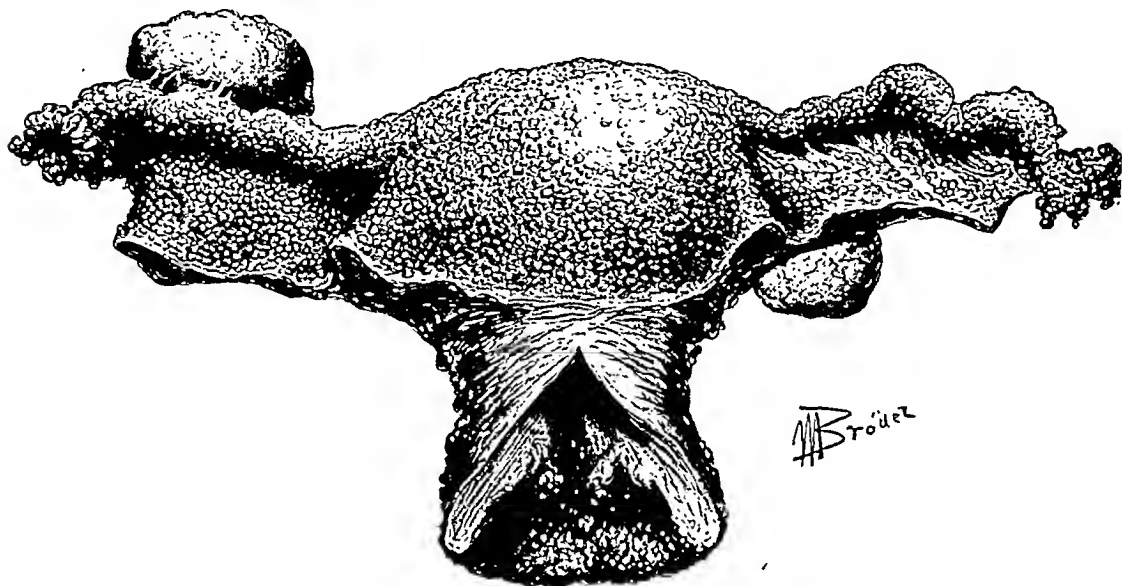


FIG. 552.—TUBERCULOUS PERITONITIS.

Showing the way in which the uterus, tubes, broad ligaments, and ovaries are studded with tubercles. There is also a commencing tuberculosis of the tubal mucosa. The case is further complicated by a coincident epithelioma of the cervix. Tubercles scattered over entire peritoneum. Free fluid. Coincidental carcinoma of cervix. $\times \frac{2}{3}$.

As this condition is usually mistaken for gonorrheal salpingitis, the routine methods of search for the gonococcus must be instituted. Any chronic inflammatory nonsuppurative mass involving tubes and ovaries, often dug out with difficulty, is presumptively tuberculous as shown by the studies of J. W. Williams (1892).

Treatment.—*General.*—A tuberculous pelvic disease, whether recognized before or after operation, demands careful supervision in the way of abundant, nourishing, vitaminized food, fresh air and sunlight, and plenty of rest, coupled judiciously with regulated moderate exercise, such as we bestow upon manifestly pulmonary and joint cases.

Surgical.—Operation is called for where the pelvic disease causes pain, or is progressive, or where collections of caseated material with pus form lateral

of tuberculous salpingitis is relatively slow. Sixty per cent of our patients, however, left the hospital in less than one month; 10 per cent were compelled to stay longer than two months.

The complications are fecal fistula, urinary fistula, and intestinal obstruction. Phlebitis and embolism do not occur often. In two-thirds there were no complications; they occur oftenest in the febrile group.

Results.—Seven per cent died in the hospital. The gravity of the prognosis is measurable by the gravity of the local lesion and the existence of other active foci. The inadvisability of operating in the presence of a definite or highly

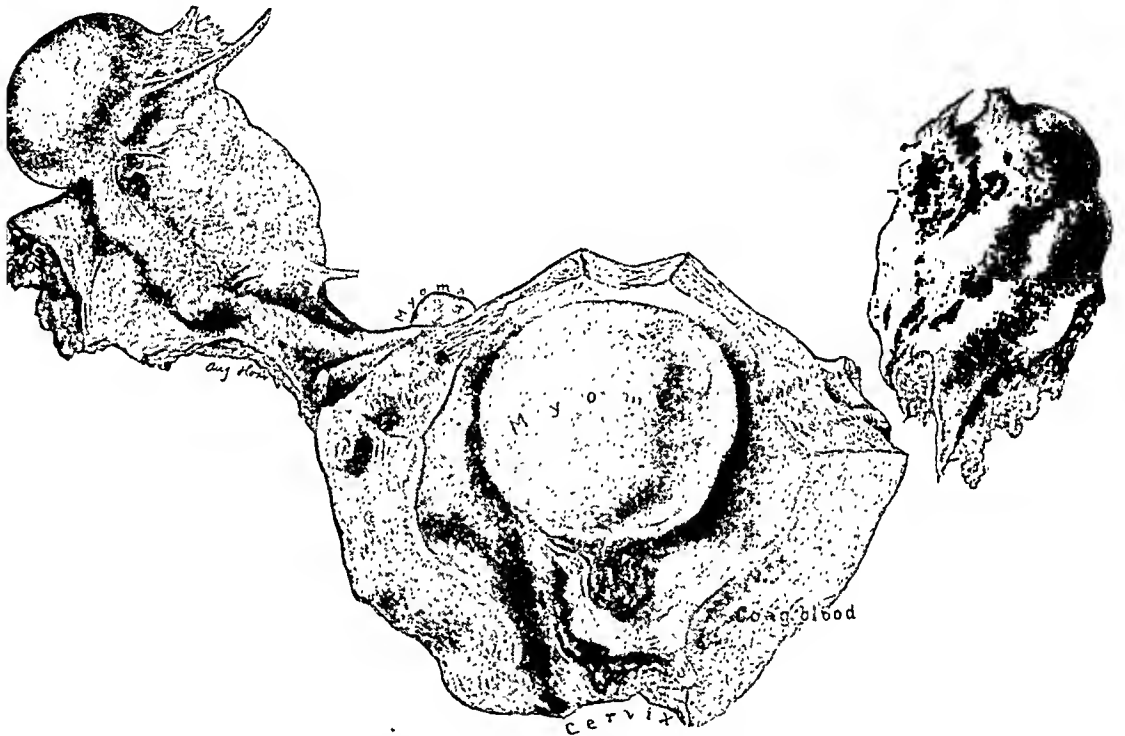


FIG. 554.—MYOMATA UTERI COMPLICATED BY TUBERCULOSIS OF THE UTERUS, TUBES, AND OVARIES.

probable pulmonary tuberculosis is revealed by the fact that 15.5 per cent of this group die within a short time after operation. Of those with no clinical pulmonary signs, the mortality is but 5 per cent. Those who are febrile before operation are also a bad risk, yielding a mortality of 11.2 per cent in a group of 125; with no preoperative pyrexia, the mortality was 4 per cent.

Death is usually due to pulmonary, renal, or generalized tuberculosis; less often to peritonitis, intestinal obstruction, embolism, and pneumonia. In general, the better the preoperative condition, the better the prognosis.

Late results following the operative treatment are good, barring the complications named. About half of our group has been heard from and almost all have regained perfect health with relief from abdominal pain and bladder disturbances, two-thirds losing also their gastro-intestinal symptoms. None

conceived again, although in some the possibility was preserved. Between 80 and 90 per cent of all the late deaths attributable to the disease occurred within a year after operation, usually from pulmonary tuberculosis. Some operators have reported 90 per cent alive three years after operation.

All patients need watching for several years and with the slightest suspicion of a recrudescence should be placed under strict medical supervision.

CHAPTER XXXVI

EXTRA-UTERINE PREGNANCY AND PREGNANCY IN A RUDIMENTARY UTERINE HORN

ROBERT M. LEWIS

EXTRA-UTERINE PREGNANCY

Etiology

DECIDUAL REACTION IN UTERINE TUBE
TUBAL POLYP
ATRESIC TUBE
MIGRATION OF OVUM
PERSISTENCE OF FETAL TYPE OF TUBE
DIVERTICULA FROM LUMEN OF TUBE
ACCESSORY OSTIA
INFLAMMATORY AFFECTIONS
PERITONEAL BANDS AND ADHESIONS, COMPRESSING TUBE
MYOMA UTERI
PAROVARIAN CYST
CERVICO-ABDOMINAL FISTULA AFTER HYSTERECTOMY

Classification

OVARIAN PREGNANCY
INTERSTITIAL PREGNANCY
TUBAL PREGNANCY

Clinical History

Diagnosis—Summary of Essential Symptoms

Chorio-Epithelioma of the Uterine Tube

Multiple Pregnancy

Repeated Extra-uterine Pregnancies

Fetal Abnormality

Treatment

GENERAL
OPERATIVE
 Abdominal
 Vaginal
AFTER CARE
ADVANCED EXTRA-UTERINE PREGNANCY
INTERSTITIAL PREGNANCY

Mortality

PREGNANCY IN A RUDIMENTARY UTERINE HORN

EXTRA-UTERINE PREGNANCY

When the fertilized ovum is arrested at any point between the graafian follicle and the uterine cavity and there undergoes development, we designate

the condition as an extra-uterine or ectopic pregnancy. The ovum may be arrested within the ovary or in any portion of the uterine tube from its fimbriated extremity to its interstitial portion inclusive. Extra-uterine pregnancy is primarily almost always situated in the tube but may become tubo-ovarian, abdominal, or intraligamentous, or even uterine in the further course of its development. Ovarian pregnancy is a gynecological rarity.

Etiology.—The factors which lead to the arrest and development of the fertilized ovum within the oviduct are usually of a mechanical nature by which the downward progress of the ovum from the graafian follicle to the uterine cavity is impeded.

Such cause may be classified under three heads:

1. Obstacles within the lumen of the tube, by which its caliber is diminished.
2. Diseases of the tubal walls and peculiarities in its anatomy or form.
3. Factors acting external to the tube, by which its lumen is encroached upon or obliterated.

In particular the causes may be classified as:

- (a) Decidual reaction in the uterine tube
- (b) Tubal polyp
- (c) Atresia of one tube with external migration of the fertilized ovum or the spermatozoa from the opposite side
- (d) Migration of the ovum
- (e) Persistence of fetal type of tube
- (f) Diverticula from the lumen of the tube
- (g) Torsion of the tube
- (h) Accessory ostia
- (i) Inflammatory affections
- (j) Peritoneal bands and adhesions compressing the tube
- (k) Myoma uteri
- (l) Cervico-abdominal fistula after hysterectomy, and one might add peculiarities of the ovum, such as excessive size, due to twin pregnancy

The earlier writers upon this subject were greatly hampered in studying the etiology of extra-uterine pregnancy by erroneous views as to the place of meeting between the ovum and the spermatozoön. It was formerly supposed that fertilization normally occurred in the upper part of the uterus and that this was brought about by the antagonistic action of the cilia of the uterine and tubal mucosæ. It was generally believed that the current produced by the cilia of the uterus was directed upward toward the fundus, while the tubal current was directed downward, and the two met and practically neutralized each other at the upper part of the uterine cavity.

Observations by Hofmeier and Mandl have shown that these views are erroneous and that the current produced by the uterine cilia in women is in exactly the same direction as the tubal current; namely, from above downward, so that the action of the cilia tends to assist the ovum in its downward progress and to interfere more or less with the upward passage of the spermatozoa; therefore, if the latter were not endowed with motility, it is probable that conception would never occur.

Observations upon animals, since the time of Bischoff, have shown that the spermatozoa under normal conditions make their way up into the tube and may even be seen swimming in the peritoneal fluid on the surface of the ovary where they may meet the ovum.

It has likewise been shown that spermatozoa retain their vitality for a considerable length of time within the tube; they have been found, for example, in the female bat six months after the last copulation.

These facts tend to show that fertilization, in the lower animals at least, occurs in the tube, probably in its upper part, and that the fertilized ovum is carried to the uterus by the action of the tubal cilia.

The observation by Dührssen of spermatozoa in the normal uterine tube of a woman three-and-a-half weeks after the last copulation tend to show that the views adduced may also apply to the human female.

We therefore hold that extra-uterine pregnancy is due to some interference with the normal downward passage of the fertilized ovum through the uterine tube.

J. C. Webster of Chicago advanced a plausible theory resting upon purely physiological grounds; namely, that the ovum is lodged in the tube only when the stimulus of its presence is sufficient to excite the formation of decidua. Normally, the uterine tube refuses to respond, but in a state of pathological physiology, representing perhaps a reversion or evidence of degeneracy, the necessary reaction takes place, the decidua forms, and the ovum becomes nested in the viaduct instead of advancing to its normal *terminus ad quem*. Experiments in animals reveal a great difficulty in forcing an ovum to develop in a normal tube by ligating the uterine end immediately after the ovary has been fertilized.

Decidual Reaction in Uterine Tube.—The formation of tubal decidua during intra- and extra-uterine pregnancies has in late years received much attention. It is known that not infrequently under the stimulus of a normal uterine pregnancy decidual reaction occurs in one or both tubes and that scattered masses of decidual cells may also be found in one or both in tubal pregnancy. In reviewing sections of pregnant tubes from thirty-seven successive cases observed in the Woman's Clinic at Yale, eleven showed definite masses of decidual cells, in spite of the fact that the sections were transverse and taken more or less at random and were not serial sections of entire tubes.

Litzenberg believes that a certain amount of decidual reaction can always



FIG. 555.—EXTRA-UTERINE PREGNANCY GONE SOME SIX OR EIGHT MONTHS BEYOND TERM;
FALSE LABOR AND DEATH OF CHILD.

Fetus, placenta, and membranes removed together. Note sodden collapsed body and maceration of skin peeling off. Operation. Death from streptococcus infection. Measurement from head to rump 30 centimeters.

be found in pregnant tubes. He states further that a true decidua basalis is never present. Residual reaction in such instances is commonly greater in the tube at a distance from the area of implantation.

J. A. Sampson's theory of endometrial transplantation may possibly explain the appearance of cells resembling decidua in other regions than the uterine cavity. This theory as affecting ectopic pregnancy while fascinating is not as yet supported by sufficient evidence.

Tubal Polyp.—The explanation appealing most strongly to early investigators was that the ovum was hindered from entering the uterus by some obstruction in the tube, such as a polyp, which partially occluded its lumen. But from the few instances in which such an obstruction has been found in a long series of carefully examined cases, it is apparent that this is a comparatively infrequent cause.

After reviewing the end results of 125 cases of tubal disease in which conservative operations were done, A. E. Giles believes that such conservative operations performed in the case of tubes crippled by old inflammatory changes may be a potent factor in the production of subsequent ectopic pregnancies. Of his 125 patients, eight had tubal pregnancies later.

Attempts to reproduce ectopic pregnancies experimentally in animals by transplanting small particles of endometrium into the lumen of a scarified tube, or upon an ovary or part of the pelvic peritoneum, have been unsuccessful. Apparently but few efforts of this sort have been made. The suggestion comes from L. A. Sutton that certain extra-uterine pregnancies owe their existence to ectopic endometrial implants. R. M. Lewis has also suggested independently that the same mechanism may account for the formation of tubal decidua which may in some instances be the determining factor in producing a tubal pregnancy.

Atresic Tube.—The external migration of the fertilized ovum from one side which is patulous to the opposite tube whose lumen is occluded in some part of its course, offers a satisfactory explanation for some.

A case described by J. W. Williams affords convincing proof of this mode of origin. The left uterine tube was the seat of two extra-uterine pregnancies. At its uterine end was a small sac containing the skeleton and calcified remains of a fetus which completely occluded that portion of the tube and from the satisfactory history obtained clearly represented the remains of an extra-uterine pregnancy of twelve years previous. The lateral end of the tube contained the placenta and membranes of a four months' pregnancy which had ruptured, allowing the escape of the fetus into the abdominal cavity where it was found alive at the operation. The left ovary was small and atrophic with no sign of a recent corpus luteum. The right tube showed evidence of perisalpingitis and endosalpingitis, but its fimbriated extremity was patent; the right ovary contained a corpus luteum, corresponding in size to the duration of the pregnancy.

It is apparent, therefore, that the spermatozoön could not have passed the occluded portion of the tube where the lithopedion lay, while the absence of a corpus luteum on that side is conclusive evidence that the ovum of the second recent pregnancy must have come from the opposite side where the corpus luteum was found. The one plausible explanation is that the spermatozoön passed through the right tube, fertilized an ovum from the right ovary, which migrated to the left tube, passed through its patent fimbriated extremity, and made its way onward until arrested by the lithopedion, where it perforce developed.

It is also theoretically possible for a spermatozoön to migrate from the normal to the diseased side where it may fertilize an ovum and then may pass up the diseased tube to the point of atresia and there develop.



FIG. 556.—TUBAL DIVERTICULA FORMING TWO ROUNDED EMINENCES ON UPPER BORDER OF AMPULLA.

Peritoneum intact; mucosa of tube cleft through, as though attempt had been made to form two additional tubal orifices. $\times 1$.

Migration of Ovum.—There is reason to assume that such an external migration of the ovum occurs comparatively often; at first sight puzzling observations at the operating table seem to offer the explanation, for one frequently finds both tubes and ovaries hanging low behind the uterus, with the fimbriated extremity of a right tube in contact with the left ovary and vice versa.

In one instance I removed a diseased tube on one side and a diseased ovary from the opposite side, leaving only a right tube and left ovary. Pregnancy occurred shortly, and the patient was delivered at term; at a later date I removed the remaining tube for an extra-uterine pregnancy.

Persistence of Fetal Type of Tube.—W. A. Freund has shown that a congenital malformation of the tube may have much to do with an extra-uterine pregnancy, as the fetal tube has a narrow lumen and is markedly convoluted; the persistence of the type, therefore, tends, both by its narrowed caliber as well as by the greater distance the growing ovum has to travel, to bring about a retention in the tube. Abel also attributed much importance to the convolutions sometimes found in tubes of a fetal type.

Diverticula from Lumen of Tube.—Diverticula from the lumen of the tube are occasionally responsible for the ectopic lodgment of an ovum. Attention was directed to this almost simultaneously by Landau and Rhein-stein.

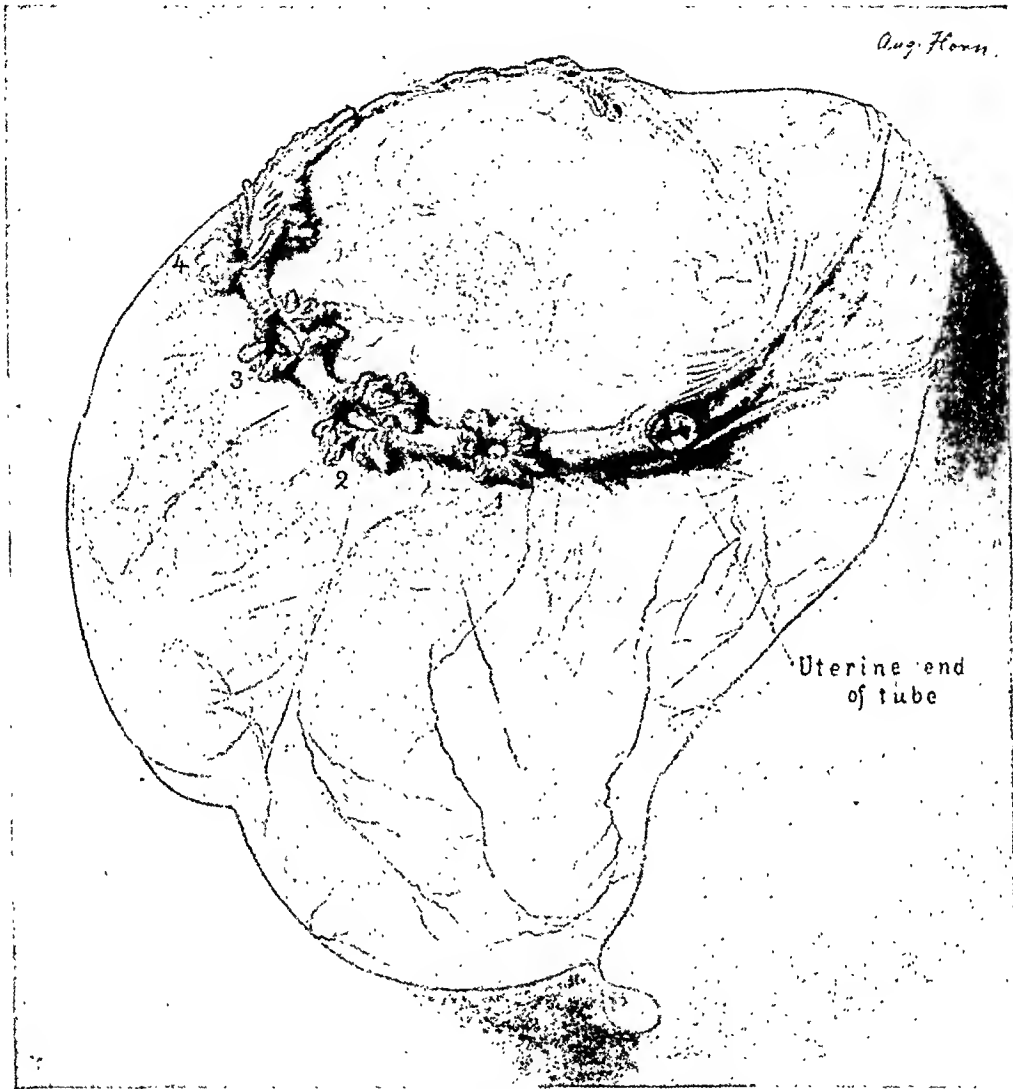


FIG. 557.—PAROVARIAN CYST DEVELOPING BENEATH TUBO-OVARIAN FIMBRIA.

Uterine tube has three well-developed accessory ostia in addition to normal tubal orifice at 4. Cesarean section operation; removal of living child and parovarian cyst measuring $11 \times 8 \times 4$ centimeters. Recovery. $\times \frac{1}{10}$.

These diverticula are little offshoots from the tubal lumen extending out into its muscular wall and penetrating it for a greater or lesser distance, frequently running parallel to the tubal lumen, and eventually ending as a culdesac, Figure 556. Should a fertilized ovum enter such a diverticulum, it would naturally advance to its blind end and lodge there to undergo further development. It is apparent that a rupture will occur earlier here than when the lodgment is in the tubal lumen.

Accessory Ostia.—The accessory tubal ostia (Kossmann, *Ztschr. f. Geburtsh. u. Gynäk.* 27: 266) act much as diverticula in breaking the continuity of the tubal wall and interfering with the progression toward the uterus. This explains only those, however, occurring in the ampullar portion where the ostia are usually found, Figure 557. An extra-uterine pregnancy developing in the canal of an accessory ostium is furnished by F. Henrotin (*Rev. de gynéc.*, 1898, 2; 633). The right uterine tube with a normal pavilion had also an accessory little tube 2 centimeters behind the pavilion, 5 millimeters in length, and 4 millimeters in diameter, communicating directly with the lumen of the tube. On the opposite side was an ovoid tumor 4.2 by 3.2 by 2.5 centimeters attached by a pedicle 5 millimeters in diameter to the under border of the tube. On the surface of this sac was an accessory pavilion 5 or 6 millimeters in length and 3 millimeters in diameter, resembling the first accessory ostium. This remarkable pedunculate sac was an extra-uterine ovum filled with coagulated blood. In the clot chorionic villi were found and the walls of the sac characterized by large vascular spaces.

Inflammatory Affections.—Orthmann and Tait believed that inflammatory affections of the tube were extremely important etiologically. Tait suggested that catarrhal salpingitis led to the production of an extra-uterine pregnancy by the destruction of the ciliated epithelium, interfering with the normal downward current of the tubal secretion and allowing the entrance of the spermatozoa which then fertilized the ovum within the tube. The fallacy of this has been demonstrated by A. Martin. It is generally admitted that spermatozoa readily make their way up the normal tube in spite of the downward current and that normal fertilization probably is extra-uterine; a careful examination of inflamed tubes shows that the cilia are rarely destroyed even in a well-marked salpingitis. Cilia also are readily demonstrated in nearly every case of tubal pregnancy. Frommel, Wyder, and Orthmann have particularly noted the well-preserved tubal epithelium with its cilia. J. Veit and J. Zedel have noted an extremely active movement upon examining immediately after operation.

Possibly the thickening of the tubal walls accompanying marked salpingitis facilitates the arrest of the ovum by interfering with the peristaltic movements and choking the lumen.

Of still greater importance is the thickening and agglutination of mucosal folds serving to entrap the fertilized ovum during its tubal transit. Whatever explanation, chronic salpingitis undoubtedly does act as a prolific predisposing cause.

Hahn on the basis of 240 cases from the Vienna hospitals concluded that gonorrhea is the commonest cause of extra-uterine pregnancy, further noting that it is commoner in large towns where gonorrhea is oftenest seen and where both of these affections are simultaneously increasing. He draws the natural conclusion that in spite of all prophylactic and social hygienic measures, the

best prophylaxis lies in the protection of the individual from gonorrheal infection.

Peritoneal Adhesions.—Peritoneal adhesions, binding down the tube and restraining its movement, may not infrequently play a part in the etiology. We frequently find at operation a bilateral old inflammatory disease with a history of repeated attacks of pelvic peritonitis. It is furthermore more suggestive that an ectopic pregnancy occurs often in women long sterile.

A dense adhesion stretching across the tube and constricting its lumen may likewise be a cause. In one instance I found the left tube so constricted by vesical adhesions across its isthmus that it was nearly severed, and the lumen almost occluded. A twist in the tube, practically obliterating its lumen, with the pregnancy in its distal side, was the apparent cause in one of Williams's thirty cases.

Myoma Uteri.—A myoma at the cornu (Leopold) may so distort and compress the tubal lumen and interfere with its functional activity as to offer a marked obstacle to the passage of the fertilized ovum toward the uterus. The number of instances in which uterine myomata have been found associated with ectopic gestation is striking and significant. One of our colored patients with a large multinodular fibromyoma entered the hospital for operation with no history suggesting pregnancy or any tubal disease; her one complaint was menorrhagia. As she entered the operating room on a stretcher, she cried out with a violent pain in the left pelvis. She was immediately anesthetized and on opening the abdomen free blood was found and in the right tube was an ectopic pregnancy which had ruptured so dramatically just a few minutes before.

Parovarian Cyst.—Another source of obstruction to the onward movement of the ovum may be found in a parovarian cyst, as illustrated in Figure 559, where a small cyst on the right side has obviously flattened out the lumen of the tube sufficiently to check the transit upon encountering the constricted area.

Cervico-abdominal Fistula after Hysterectomy.—The cases of Koeberle and of Lecluyse (*Bull. de l'Acad. de méd. de Belge*, 1869) may be finally mentioned

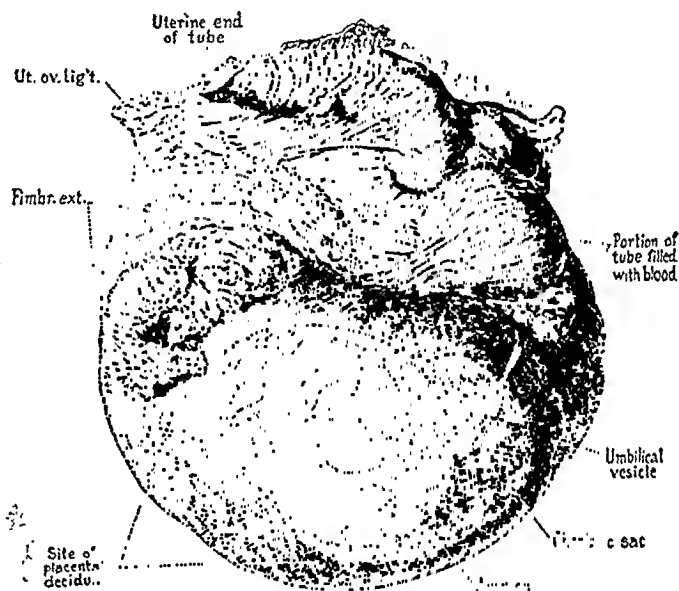


FIG. 558.—TUBE AND OVARY BOUND DOWN BY STRONG OLD ADHESIONS INTO ONE GLOBULAR MASS.

Fimbriated extremity almost disappeared; its lumen remains patulous. Small ovum with chorionic sac, umbilical vesicle, and amnion outlined within. Tube behind ovum filled with blood. Operation. Recovery. Probable age of embryo seven weeks. $\times 1$.

among the rare and remarkable in the annals. Here, after the removal of the uterus, spermatozoa found ingress to the abdominal cavity through a cervical fistula and fertilized an ovum, presumably in one of the tubes.

An interesting instance in which the patient had not missed a menstrual period but had such an exquisitely tender mass on the left side that any approach to a thorough examination was impossible, is shown in Figure 560. T. S. Cullen operated and removed both tubes; the left contained the ovum while the right was thickened and adherent, both ovaries being left. The preg-

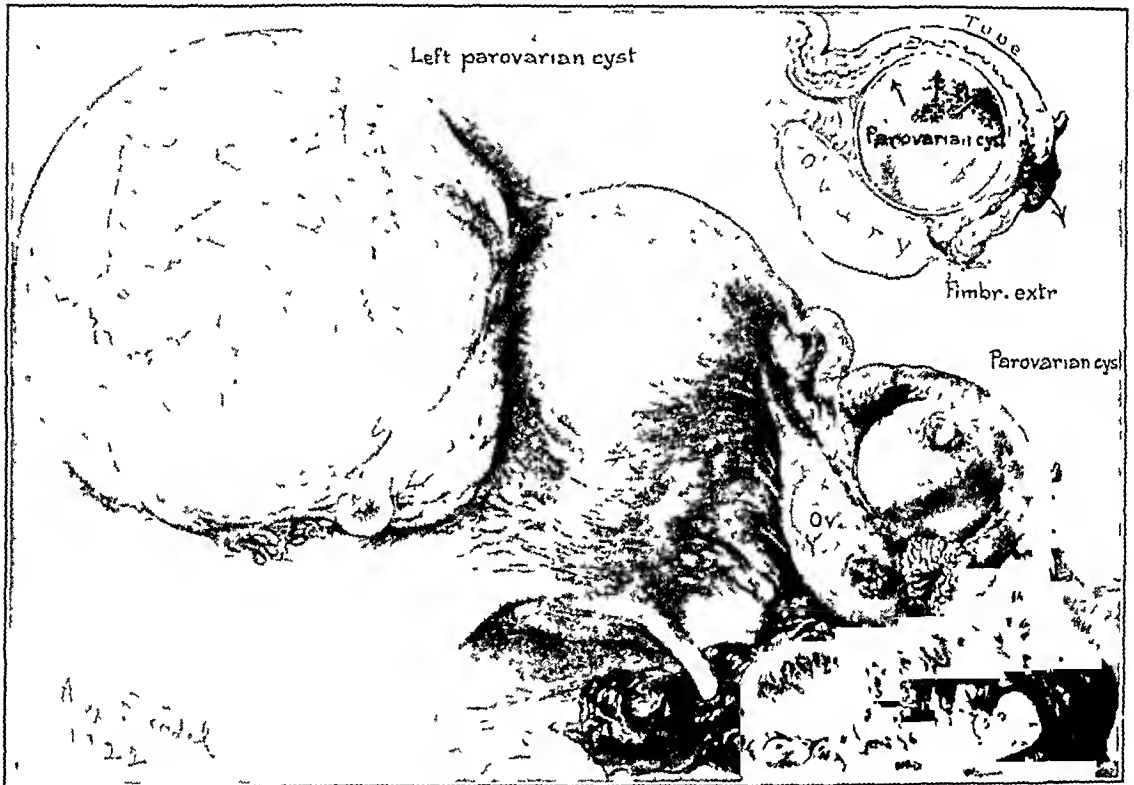


FIG. 559.—PAROVARIAN CYST ON LEFT, SIZE OF ORANGE.

Smaller cyst on right between tube and ovary. Lodgment of ovum and rupture at point indicated by arrow. Figure in right upper corner demonstrates mechanism of interference. Ovum, 2 centimeters long, lies below in clotted blood. (L. Brady.)

nant tube showed a slight rupture and there was about a liter and a half of blood in the abdomen. The left tube is interesting on account of the cyst under the tubo-ovarian fimbria. The fimbriated orifice and a portion of the tube above it were stretched out over the cyst, and at a point above it, designated by *a*, there was a constriction in the lumen of the tube. Back of this lay the ectopic sac covered with numerous vessels. A similar case is reported by Leo Brady (*Johns Hopkins Hosp. Bull.*, Dec. 1922).

Classification.—A natural classification of the forms of extra-uterine pregnancy is one based upon the original point of implantation of the fertilized ovum. When it remains and develops where it was first arrested, we designate

it as primary extra-uterine pregnancy; upon changing its position by rupture or further development, it is designated as secondary.

The primary tubal forms are, according to the site of the ovum, the interstitial, the isthmal, and the ampullar; J. C. Webster further distinguishes an infundibular form, secondarily becoming tubo-ovarian or tubo-abdominal. The tubo-ovarian form may develop in an ovarian tube where the fimbriated extremity is glued down by adhesions to a limited portion of the ovary (Hennig).

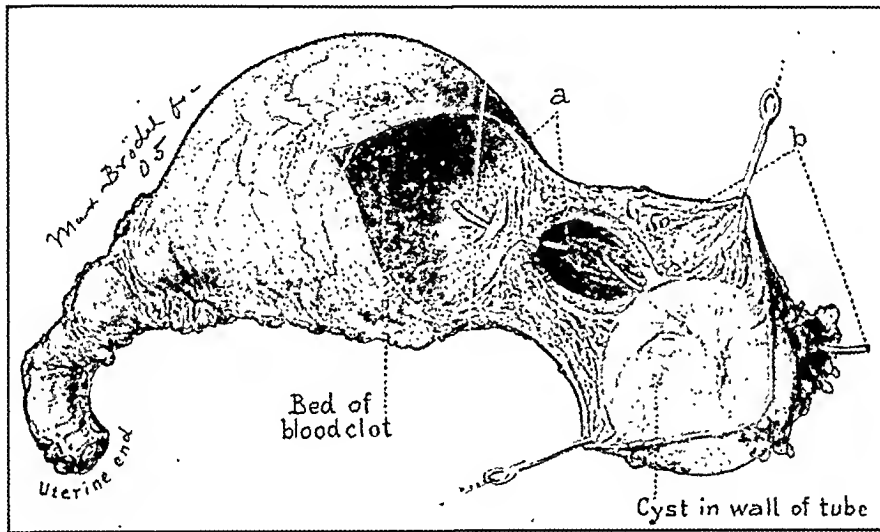


FIG. 560.—SAC LAID OPEN SHOWING CAPACIOUS CAVITY AND THIN WALLS.

Extra-uterine ovum lies above in the middle. At *a* a small opening communicates with distal portion of tube, which continues in direction indicated by *b*. Cyst underlying tube, in close relation to tubo-ovarian fimbria, seen below to right.

The table shows the changes each of the primary forms may undergo:

OVARIAN	INTERSTITIAL	TUBAL
Abdominal (fetus dies)	Abdominal (fetus dies)	Tubo-abdominal
Intra-uterine	Intraligamentary (fetus dies)	Tubo-ovarian
	Mole (fetus dies)	Abdominal
		Intraligamentary (fetus dies)

Ovarian pregnancy is undoubtedly the rarest of all forms. Norris accepts nineteen reported prior to 1909 as genuine. Loekyer admits twenty-two reported as ovarian pregnancy from 1909 to 1917 as indisputable. Wynne and Meyer add one from the Johns Hopkins Hospital to those previously reported in 1919. L. Sutton (*Am. J. Obst. & Gynec.*, Jan. 1924) reports the number of authentic ovarian pregnancies as forty-seven. It seems, therefore, that the condition is not so rare as once supposed.

According to Schumann, ovarian pregnancy is apt to last longer and indeed

more frequently goes to term than the tubal form. This he attributes to the greater elasticity and resiliency of the ovary. The ovary is also thicker than the tubal wall and is less easily penetrated by the chorionic villi.

Almost all tubal pregnancies occur either in the isthmus or the ampulla and but rarely at its fimbriated end. Zweifel distinguishes (*Arch. f. Gynæk.*, 1891,

41) a further form in which the ovum does not enter the lumen of the tube but becomes attached to the tubo-ovarian fimbria and there develops, Figure 561. Rarely a tubal pregnancy develops and reaches full term without rupture, but more frequently the sac ruptures into the abdominal cavity, or within the folds of the broad ligament, or through the fimbriated end of the tube.

There is considerable doubt as to the existence of a primary abdominal ectopic pregnancy. Those in which the placenta is found attached to other structures than the tube or ovary are presumably secondary; the ovum originally tubal or ovarian having outgrown and become detached from its original site attaches itself secondarily to other structures.

Judging by personal experiences a rupture within the folds of the broad ligament, with intraligamentary

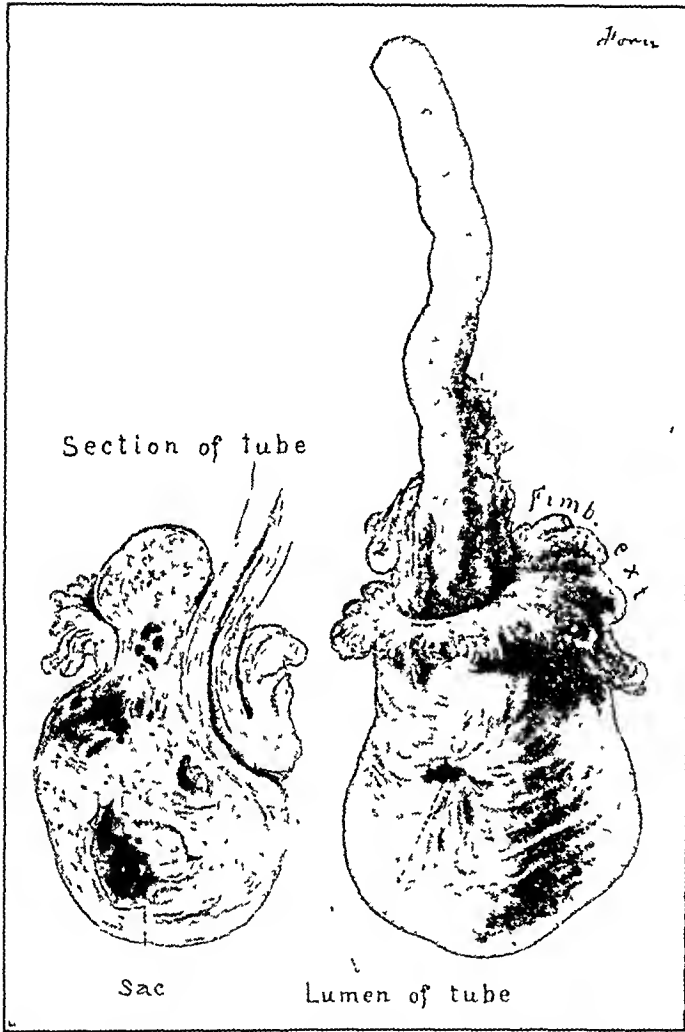


FIG. 561.—TUBAL PREGNANCY.

Ovum seen imbedded in tubo-ovarian fimbria. Club-shaped tube, with its bulbous, swollen end and a small lumen about the middle surmounted by a ring encircling tube which marks fimbriated extremity, presents appearance of an edematous inverted tube. Section on left, however, corrects this inference and shows great thickening of tubo-ovarian fimbria is due to lodgment of amnion in its interior. Operation. Recovery. $\times \frac{1}{40}$.

or subperitoneopelvic development, occurs rarely.

In several old pelvic inflammatory cases we have found the tube and ovary so enveloped by adhesions, presenting a smooth surface toward the abdominal cavity, that the tubal pregnancy apparently lay beneath the peritoneum and might well be designated as pseudo-intraligamentary, being differentiated from

the true intraligamentary by the fact that a little patience enables one to separate the adhesions and free the pregnant tube.

Statements made by various observers as to the form of extra-uterine pregnancy encountered are so often based upon insufficient examination of the structures that it is important to keep clearly in mind all criteria by which the exact form is established; it is also important that these criteria should be adhered to in any description. The first bitter discussion in this ancient and well-fought field was over the classification, arising between no less distinguished men than Mauriceau and Regner de Graaf over a case in the year 1669. De Graaf insisted that the woman from whom the specimen was received post-mortem died of a ruptured tubal pregnancy, while Mauriceau contended that the pregnancy was not tubal at all, but a hernia of the uterine tissue, and he cited as a criterion the attachment of the round ligament to the outer side of the sac instead of the inner, furnishing at the same time a clear sketch.

Criteria of an Ovarian Pregnancy.—Here it is necessary to demonstrate the criteria laid down by Spiegelberg; namely, that the tube is intact and has no organic connection with the gestation sac, that the tumor is connected with the uterus by the utero-ovarian ligament, that the walls of the sac contain graafian follicles in various places, and that the albuginea of the ovary passes directly into the tumor wall. To these demands Norris adds that the tube on the affected side should show no microscopic evidence of gestation. It seems unreasonable to insist that an embryo be found *in situ*.

Criteria of an Interstitial Pregnancy.—An interstitial pregnancy is distinguished from the commoner forms by the round ligament on the outer side of the sac with the uterine tube. The uterus is enlarged and intimately connected with the inner side of the tumor of which it appears to form an organic part.

The tubo-uterine mass may bulge into the uterine cavity, being separated by a small opening, or it may be freely connected with it. If the fetus escapes into the uterus, the placenta stays behind in the wall communicating with the uterine cavity through the opening.

An interstitial pregnancy may be confused with pregnancy in a rudimentary horn of the uterus in which the round ligament is also located on the outer side of the sac. This error will not occur if the uterine body is noted rounded off toward the rudimentary side and the attachment of the pedicle of the tumor low down on the side of the uterus is observed.

The uterine tube is also inserted lower down on the side of the tumor than on the other side. An interstitial pregnancy may become intraligamentary (Martin, Leopold).

The frequency of interstitial pregnancy as compared with other forms of extra-uterine gestations is generally taken to be less than 3 per cent. In a series of 304 cases of extra-uterine pregnancies observed in the Johns Hopkins wards, Meyer and Wynne find only two interstitial (*Johns Hopkins Hosp.*

Bull., No. 324). Summarizing case reports from other clinics of 1,547 ectopic pregnancies, eighteen were interstitial (1.16 per cent). A positive diagnosis of the interstitial form is difficult or impossible before the abdomen is opened.

As a rule they result in early rupture. Acute dangerous hemorrhages due to the extraordinary vascularity of the site are more frequent with the interstitial than with any other form. In this group, pain often precedes the



FIG. 562.—TYPICAL TUBAL PREGNANCY.

Relation of extra-uterine ovum at about $3\frac{1}{2}$ months to ampullar portion of uterine tube, in which it lies embedded with voluminous placenta. At outer pole on left, placental villi protrude through rent (V).

irregular uterine bleeding. The reverse is often true in the more ordinary tubal types.

Criteria of a Tubal Pregnancy.—When unruptured, the tumor lies in the uterine tube with a pedicle formed by a part of the tube and the mesosalpinx, holding the same relation to the uterus, broad ligament, and ovary as does a hydrosalpinx, Figure 562, that is to say, the body of the uterus is well defined and separate from the tumor on its inner (median) side, the ovary is found intact, the layers of the broad ligament are not separated, and the round ligament lies on the median side of the tumor.

When the tubal pregnancy is ruptured, if the rupture is recent, the fact

is evident from the extravasated blood, and an examination of the tube may show the point of laceration; if it is a tubal abortion the fimbriated end is dilated and the ampulla is often choked with firm clots, forming a "tube cast." The tube usually contains a portion of the ovum, and villi may be found choking the tear. Such a case is shown in Figures 563 and 564, a ruptured right uterine tube plugged by villi and clots. On opening the abdomen the outer third of the tube was found to contain an old blood-clot about 4 centimeters in diameter, rounded, and freely movable. On the surface were numerous large vessels. The tube was removed and the left round ligament sutured to the posterior surface of the uterus and the left ovary suspended to the round ligament. The fetus is seen within the tube.

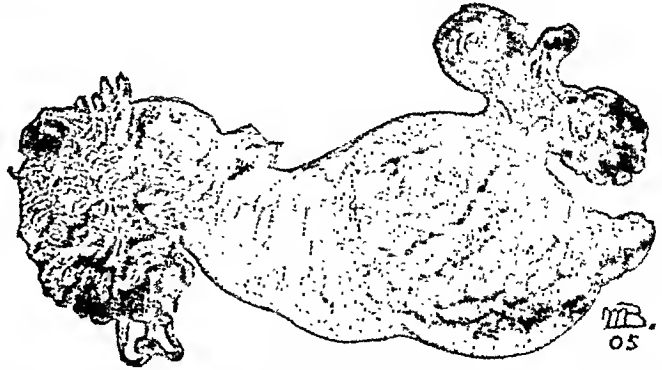


FIG. 563.—RIGHT UTERINE TUBE SEAT OF EXTRA-UTERINE PREGNANCY RUPTURED AND DISCHARGING BLOOD INTO PERITONEAL CAVITY. SEAT OF RUPTURE PLUGGED BY CLOTS AND VILLI.

Careful observation is necessary to establish an intraligamentary form, for there is great danger of confusing it with an encapsulated ruptured intraperitoneal form. The following are the criteria of differentiation: The tumor occupies the relations to the broad ligament and the uterus of an intraligamentary cyst; the mesosalpinx is unfolded, together with the anterior and posterior layers of the broad ligament, and the pelvic peritoneum and even the peritoneum of the anterior abdominal wall are detached from the cellular tissue to cover the tumor.

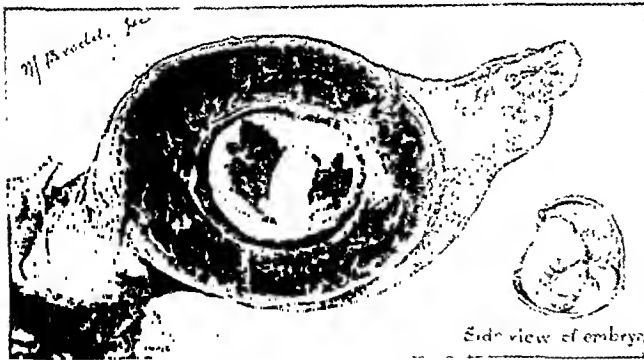


FIG. 564.—SAC SHOWN IN FIGURE 563 CUT OPEN, SHOWING LITTLE OVUM (FIGURE BELOW TO RIGHT) SURROUNDED BY MASS OF BLOOD-CLOTS DESTROYING VITALITY OF OVUM.

The ovary lies somewhere on the surface of the tumor, flattened or drawn out even as much as 6 centimeters, but

The ovary lies somewhere on the surface of the tumor, flattened or drawn out even as much as 6 centimeters, but

the ovarian tissue is not distributed over any considerable area, affording a differentiation from ovarian pregnancy. The uterus lies closely applied, deprived of its broad ligament on the side of the pregnancy and pushed toward the opposite side. The round ligament extends from the cornu uteri over the front of the tumor, which is also in intimate relation with the upper vagina. Muscular tissue appears abundant in the sac wall, derived from the tube and the subserous tissues.

Clinical History.—The classical picture of an extra-uterine pregnancy portrays a woman who has borne one or more children and has remained sterile over a term of years. The period of infertility then ends in an ectopic pregnancy. F. S. Newell, *per contra* (*Med. & Surg. Rep. Bost. City Hosp.*, 1905), found that fifty patients out of sixty had been pregnant at a comparatively



FIG. 565.—DECIDUAL REACTION IN UTERUS (TUBAL PREGNANCY).

1. Hypertrophied endometrial glands.
 2. Decidual reaction in stroma.
- (J. H. U., Gyn.) $\times 100$.

recent date. In a recent series from the Johns Hopkins Hospital, 12 per cent of the tubal gestations were first conceptions, and the average interval since the last delivery was three and one-half years.

The fertilized ovum once lodged in the tube develops as long as the fetus lives, rarely up to the eighth or ninth month of pregnancy. The first symptoms are identical with those of a normal uterine pregnancy—morning-sickness,

fullness in the breasts, and enlargement of the uterine. Often the history of one or more missed menstrual periods is elicited, as for example, in twenty-four of fifty cases collected by Leo Brady. Polak emphasizes the fact that a change in the menstrual rhythm is as important and much oftener observed than the entire omission of a period.

So like a normal pregnancy may the initial symptoms appear that not infrequently unsuccessful efforts have been made to secure an abortion.

As a rule there is pelvic pain about six or eight weeks after conception. Classically it is described as so violent as to be nauseating or even to cause fainting; actually all grades of severity are encountered. It is, as a rule "cramplike" or "knifelike," recurring at irregular intervals. If severe internal hemorrhage accompanies the pain, the usual signs of loss of blood will be noted, and often pallor, rapid pulse, weakness, air-hunger, and a cold clammy skin.

In many cases, however, the symptoms are comparatively mild. In the fortunately less frequent tubal rupture, we commonly have sudden violent pain with the tragic collapse of a woman previously in good health. Occasionally death arrives before surgical aid can reach her.

Interesting and important observations have recently been made regarding referred pain due to the extravasation of blood in the pelvic and abdominal cavities.

A. Laffont (*Presse méd.*, 23 février, 1924) reports sixteen cases of tubal pregnancy with intra-abdominal hemorrhage with pain referred to sites other than the pelvis—to the epigastrium beneath the right or left costal margins, to one or both shoulders, behind the sternum, between the scapulæ, and to the base of the neck. The onset of the referred pain was noted at times shortly after tubal rupture, at others, days after this accident, apparently depending on the freedom of the intra-abdominal hemorrhage. Pain was at times very severe and again a less conspicuous symptom. In general, referred pain was noted when the peritoneal cavity was flooded with blood. In one, it recurred after operation and it was found due to a serosanguineous accumulation in Douglas's culdesac, immediately relieved by vaginal drainage. As Laffont remarks, this is good evidence that the referred pain is not due to tubal disease *per se* but to outside agencies, presumably to irritation of the sympathetic nervous system of the peritoneum.

In a case of Thomas of Strasbourg, the pain in the right hypochondrium suggested renal colic; here the severe referred pain masked all other symptoms of the ruptured ectopic pregnancy. It has been noted that pain referred to the shoulders may be accentuated by pressure on the abdomen, presumably increasing the irritation of the phrenic terminals supplying the diaphragm.

Laffont suggests that Head's theory regarding reflex pain may account for the reference to the neck and upper thorax in other pelvic lesions. If, as a result of tubal hemorrhage, the blood is limited to the false pelvis, the pain is

usually epigastric or costal marginal or in the back, while if the entire peritoneal cavity is distended, one often sees pain referred to the neck or shoulders. An interesting instance of this type was observed in the Woman's Clinic at Yale.¹ A primipara, thirty-two, who had missed one menstrual period, entered the wards May 22, 1917, with a history of irregular vaginal bleeding and abdominal pain of ten days' duration. On admission the patient was cyanotic and practically pulseless; air-hunger was distressing; pallor was obvious. The chief and striking complaint was of severe "shooting" pain in the shoulders, so violent that she cried out at intervals. Although the abdomen was tense and distended, there was little or no complaint of pain there. The diagnosis of ruptured ectopic pregnancy was established at operation, when on opening the peritoneum blood spurted out under considerable tension. She made a good recovery.

In the same clinic, another less striking but similar case of referred shoulder pain was observed under like conditions. One was also noted with pain referred to the epigastrium.

Corvese (*Boston M. & S. J.*, Dec. 11, 1924) reports three cases of ruptured ectopic pregnancy with severe pain referred to the shoulders.

Herzfeld, Rubin, Cederberg, and others have called attention to this kind of pain as a valuable diagnostic sign, especially in doubtful cases.

The shoulder pain is usually ascribed to an irritation of the phrenic nerve terminals supplying the central part of the diaphragm and transmitted from there through the phrenic nerves to the area of distribution of the suprascapular branches of the brachial plexus. The same mechanism also explains the commoner shoulder pains which are associated with lesions of the gall-bladder.

Irregular vaginal bleeding may precede or follow the pelvic pain. The loss of blood from the uterus is never great and is in no way proportionate to the internal hemorrhage. While the latter arises from ruptured or eroded tubal vessels, J. A. Sampson has demonstrated that the blood lost *per vaginam* comes from the veins of the uterus and never from the tube.

At times within the first five or six months, the uterus casts off a decidua vera, either as a complete cast of the interior of the uterine cavity or in pieces. This process accompanied by a flow of blood which may be excessive is apt to be mistaken for an abortion.

In three out of a series of 139 cases, patients passed an entire decidual cast; one of these is shown in Figure 566, which was first taken for an abortion, but an examination of the interior showed no ovum nor any point of attachment for an ovum. The patient had passed a period and twelve days later began to bleed irregularly. As she had severe and characteristic pain, an extra-uterine pregnancy was suspected and she was brought to the hospital,

¹The results in the Yale Woman's Clinic by courtesy of Arthur Morse, Professor of Gynecology and Obstetrics at Yale.

where, within twenty-four hours, she passed the cast shown. On opening the abdomen there was but little blood, although some was oozing from the end of the uterine tube. The operation consisted in the removal of the tube alone, followed by recovery.

In any long series of abdominal operations for pelvic inflammatory disease, there is sure to turn up now and then an unsuspected old extra-uterine preg-



FIG. 566.—DECIDUAL CAST.

Shaggy, villous decidual cast of uterine body thrown off about sixth week of extra-uterine pregnancy, affording positive diagnostic sign of extra-uterine condition. Cervical opening seen below; above and at corners little ears mark sites of tubal orifices. Irregular mammillated surface of interior seen in drawing to right. Operation. Recovery. $\times \frac{9}{10}$.

nancy with extensive adhesions and a small fetus buried in the neighborhood of the tube and ovary, such as is shown in Figure 567.

If the pregnancy is not interrupted, the tumor continues growing and becomes apparent on one or the other side of the lower abdomen, where it may be discovered for the first time by the patient herself.

Moderate elevation of temperature due to absorption of the blood in the peritoneal cavity is not unusual. Secondary infection of a pelvic hematocoele gives rise to pelvic peritonitis, often with a high septic temperature.

If the fetus survives the risks of rupture, hemorrhage, and the partial detachment of the sac in the early months, false labor, simulating the onset of a miscarriage or a true labor, may occur at any time during the latter months of pregnancy, followed by the death of the child and cessation of its movements, the absorption of the amniotic fluid, and the rapid diminution in the size of the

sac. These are undoubtedly the "missed labors" of our predecessors which have been dwelt upon especially by Oldham.

Only rarely does a tubal pregnancy advance to full term without any serious untoward event. At or near term, following a false labor, the fetus dies and remains *in situ* with the placenta. The mass may remain within the tube for years, becoming calcified (lithopedion) or undergoing conversion into adipocere. Large portions of the products of gestation may also be removed by phagocytosis, leaving only skeletal remains.

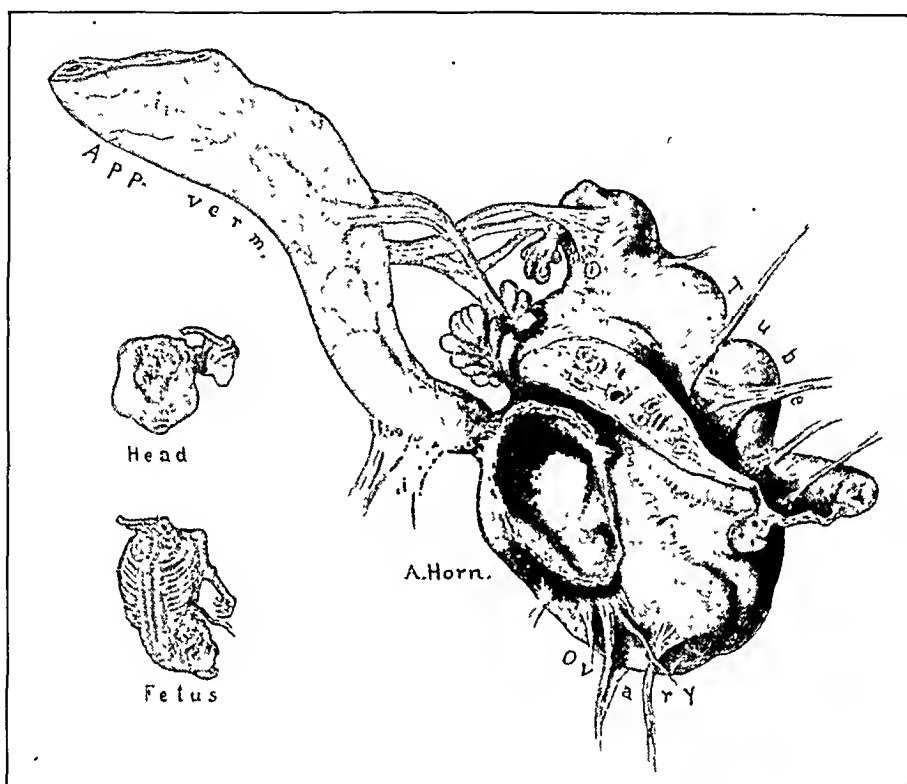


FIG. 567.—OLD EXTRA-UTERINE PREGNANCY IN WHICH FETUS WAS BURIED IN OVARY AND MASS OF ADHESIONS WITH ADHERENT VERMIFORM APPENDIX.

Operation, removal of right tube, ovary, extra-uterine fetus, and vermiform appendix. Recovery. (*The Vermiform Appendix and Its Diseases*, W. B. Saunders Co.) $\times \frac{9}{10}$.

Instances of ileus are recorded from the adhesions caused by the foreign body. Also, after the fetal death, inflammatory changes may supervene and result in the perforation of one of the hollow viscera or even of the abdominal wall. The older literature contains many instances of fetal bones discharged through such sinuses.

Diagnosis—Summary of the Essential Symptoms.—1. In many instances a history of sterility of some years' duration following one or more pregnancies is obtained. Not infrequently it is evident that in years gone by the patient has had a salpingitis. Often a first pregnancy proves to be tubal.

2. Cessation of menstruation. A careful history often reveals the omission of one or more menstrual periods. The ignorant frequently declare that

menstruation has been "regular," but careful questioning as to dates and duration and character of the menstrual discharge will usually make it evident that irregular bleeding has been mistaken for the regular period.

3. Other signs of pregnancy, such as nausea, changes in the breasts, etc., and certain signs peculiar to the individual suggest pregnancy.

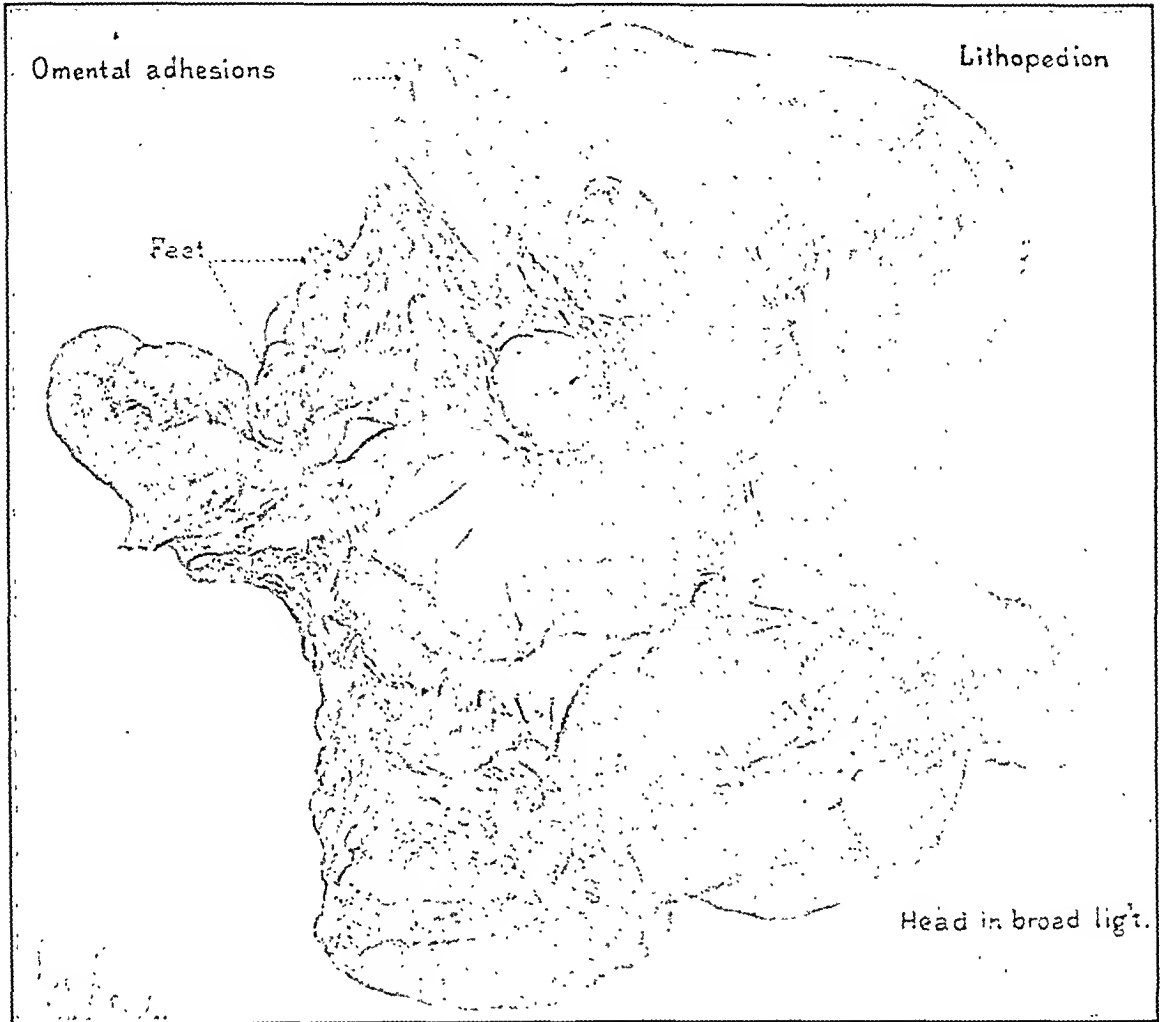


FIG. 568.—LITHOPEDION.

Case of L. S. Otell. White woman. Removed postmortem forty years after last pregnancy. (J. W. Williams.)

4. Pain in the pelvis and the presence of a tumor, sensitive on pressure, and distinct from the uterus.
5. Irregular uterine hemorrhage.
6. Sudden severe (frequently agonizing) pain, often occurring during active exertion, reaching up, or lifting. Pain recurs with more or less marked severity.
7. Marked anemia, with its associated symptoms.
8. Pain on defecation frequent. Constipation and dysuria.

9. Discharge of decidual cast or shreds of decidua.
10. Pain referred at other sites than the pelvis.

Objective signs:

1. Pallor and softening of the cervix with enlargement of the uterus to about the size of a six weeks' or two months' pregnancy. J. A. Sampson finds

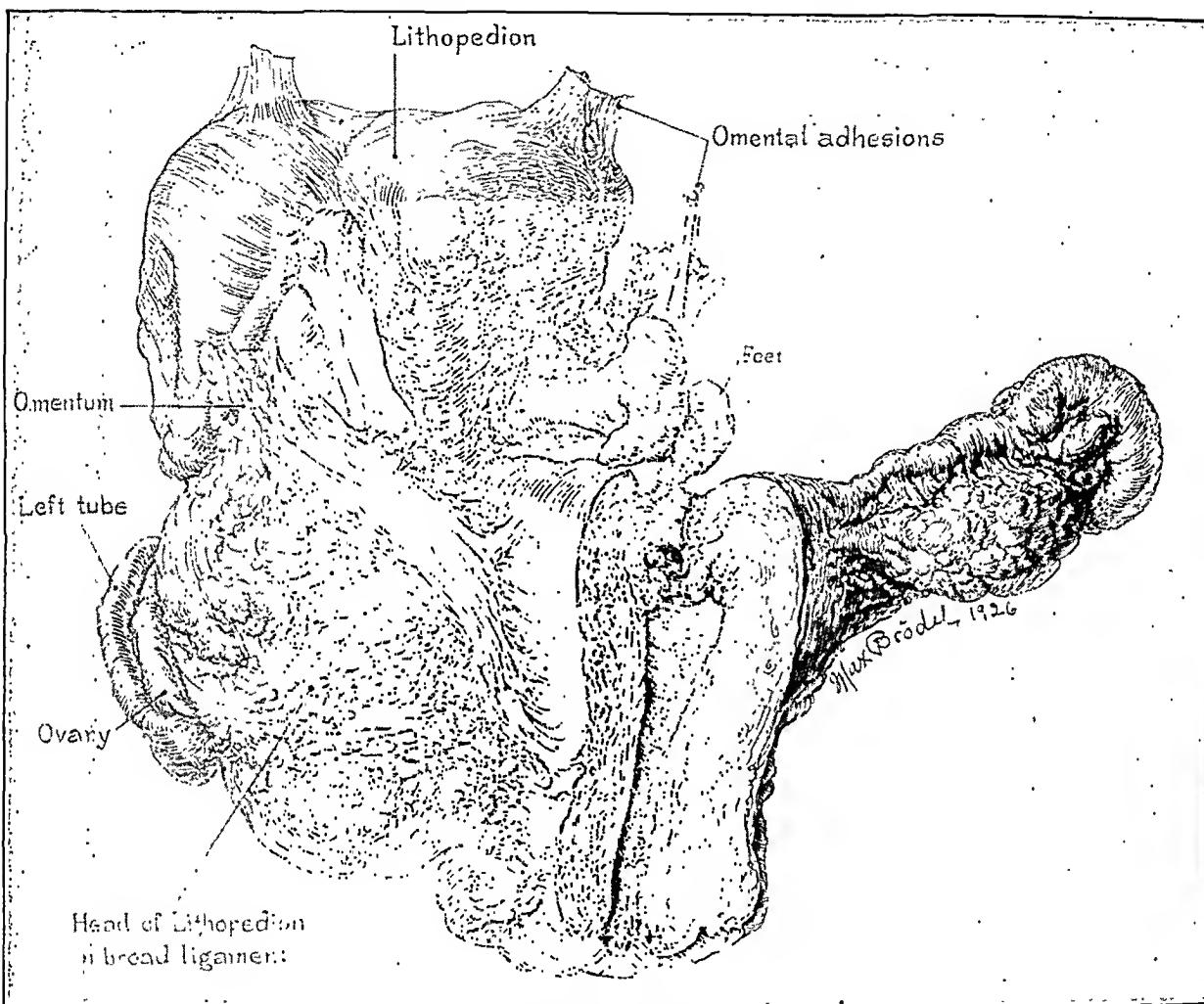


FIG. 569.—LITHOPEDION.

Posterior view of same specimen. (J. W. Williams.)

that the uterus remains subinvolved so long as any products of conception remain in the tube.

2. Formation of a tumor, usually exquisitely sensitive on pressure, at one or the other side of the uterus.

3. The recognition of an hematocele in Douglas's culdesac. The blood may be fluid or coagulated. In the latter case the mass may have the consistency of putty. If the clot is undergoing organization, a characteristic gritty crepitation is often discovered on vaginal examination. The fact that there is

obviously something in the pelvis but its relations are puzzling is more than suspicious.

4. Characteristic contractions of the uterus or, rarely, of the tumor itself.

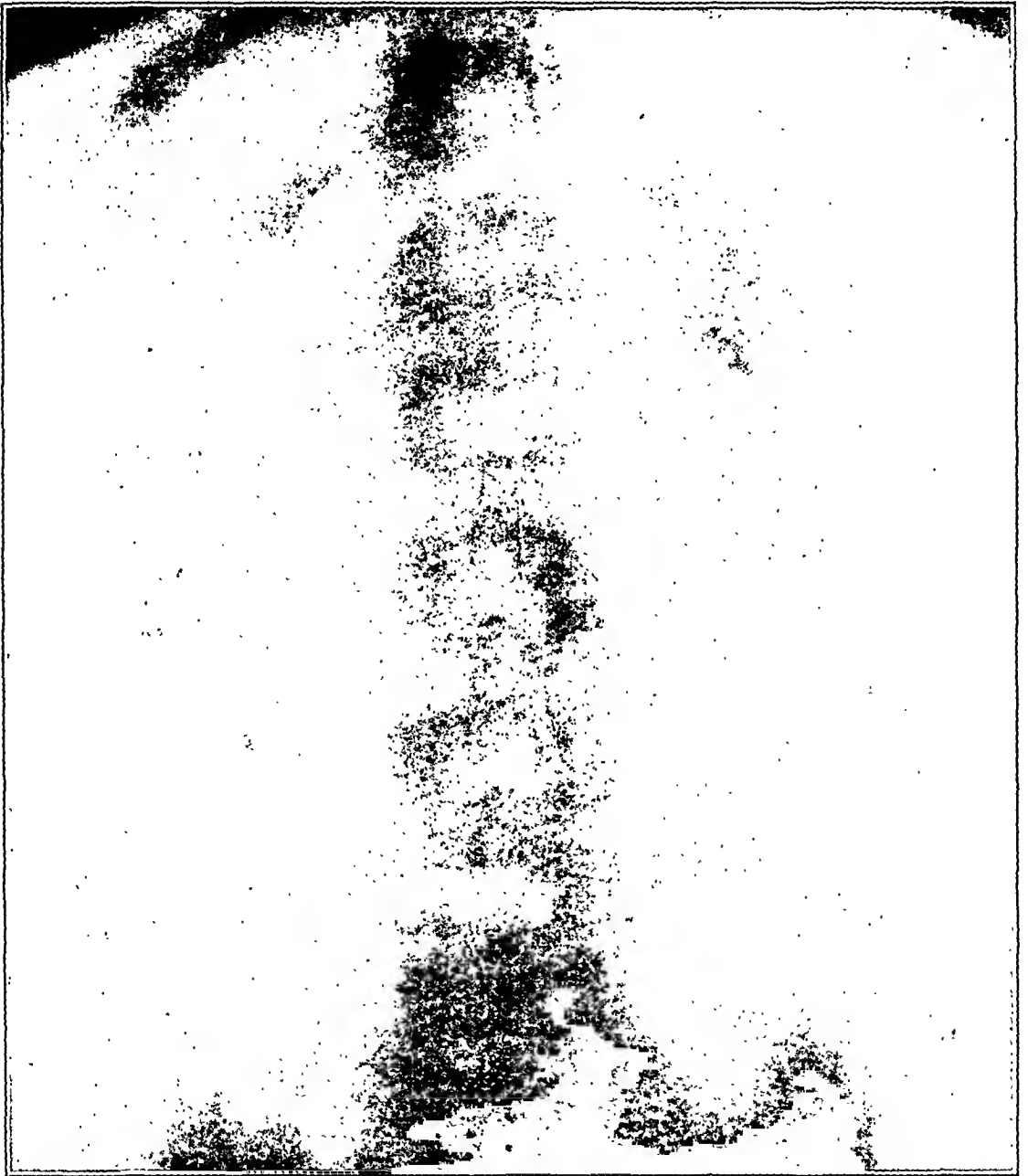


FIG. 570.—X-RAY FILM OF FULL TERM ECTOPIC PREGNANCY.
(J. J. Catlin.)

5. Microscopic examination demonstrating the decidual nature of the tissue exfoliated from the uterus.

6. Late in pregnancy the fetal parts may be felt through the abdominal wall with unusual ease. About the fifth month, fetal movements may be felt;

later on fetal heart sounds are heard unusually clearly. Sometimes the placental souffle is audible.

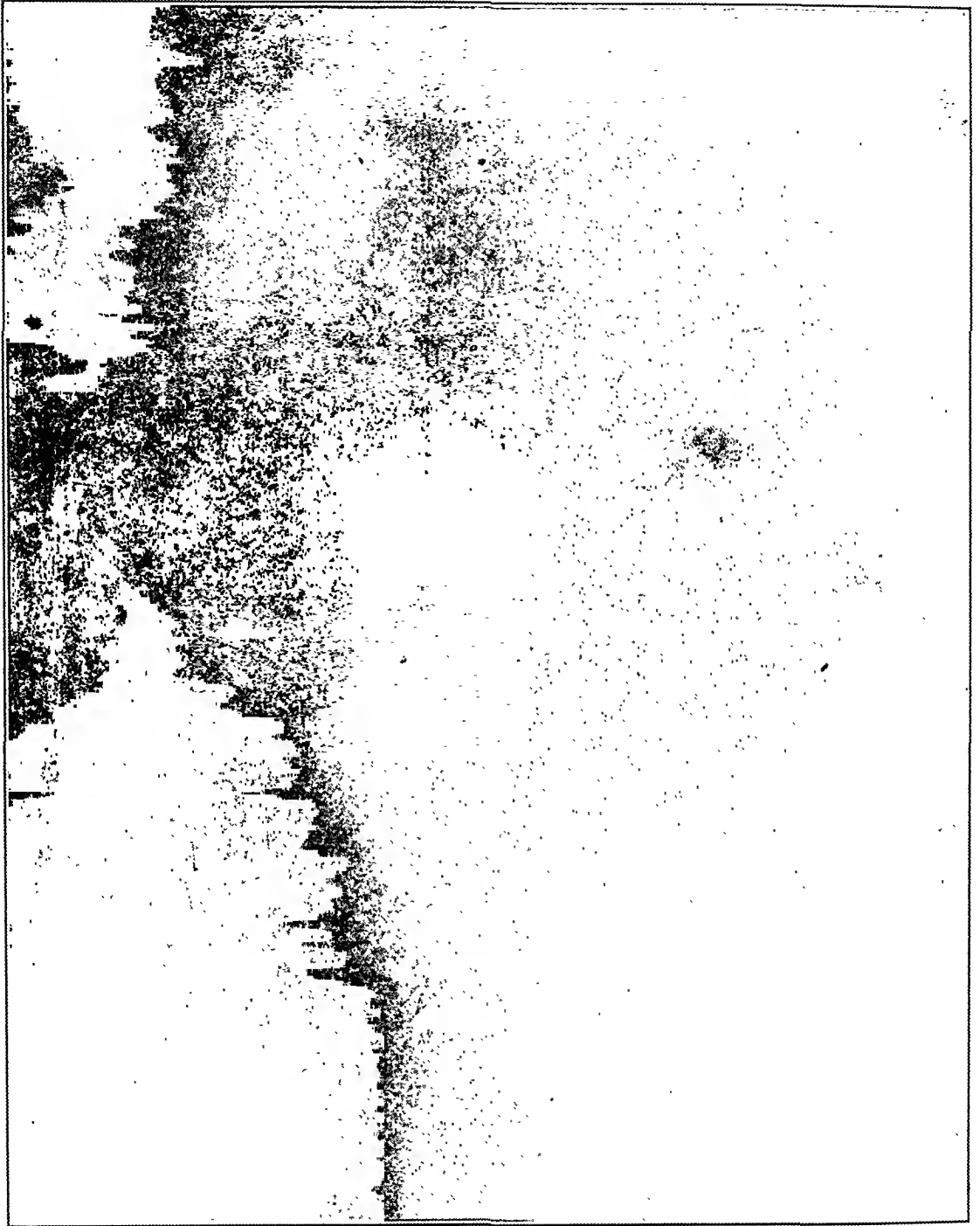


FIG. 571.—X-RAY FILM SHOWING FETUS WITH HEAD AT COSTAL MARGIN AND FEET IN LEFT ILIAC FOSSA. (J. J. Catlin.)

7. Cullen's Sign. Discoloration of the umbilicus. In 1918, Cullen called attention to the fact that in extra-uterine pregnancy, when the abdomen contains free blood, the umbilicus may be discolored—the shade varying from a

bluish-black to yellowish-green, depending on the state of decomposition of the blood. Such a discoloration is an evidence of free blood, intraperitoneal, which is usually due to an extra-uterine pregnancy.

8. Leukocyte count. The leukocyte count may aid in ruling out inflammatory conditions such as salpingitis or appendicitis. As a rule the latter

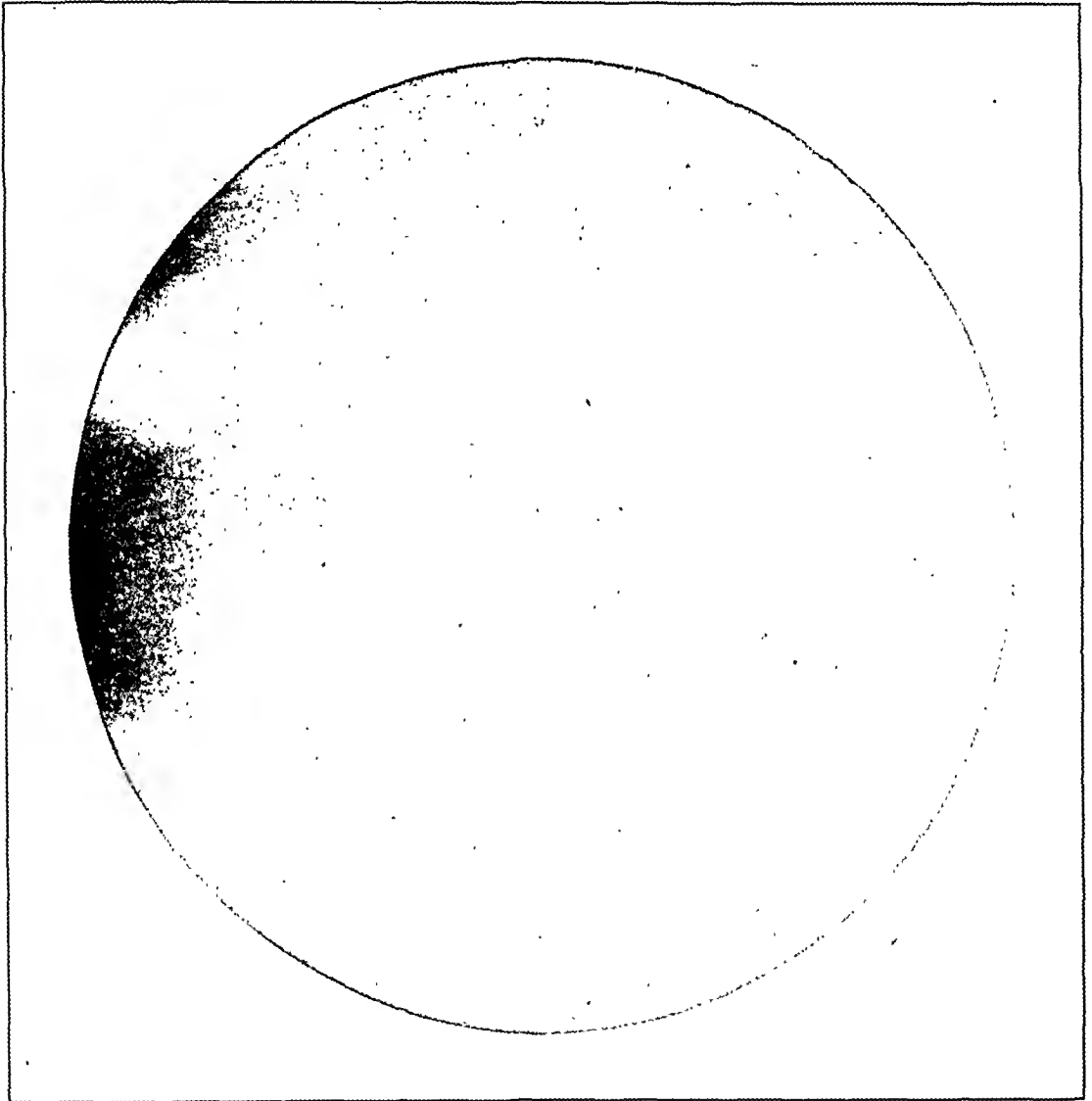


FIG. 572.—ECTOPIC PREGNANCY OF RIGHT TUBE. FREE BLOOD IN ABDOMEN.
Intraperitoneal infiltration with carbon dioxid. (I. F. Stein.)

give rise to a leukocytosis. Uninfected ectopic pregnancy does not commonly increase the leukocyte count unless there is a recent intraperitoneal hemorrhage. L. K. P. Farrar (*Surg., Gynec., & Obst.*, Nov. 1925) finds that of 150 cases of tubal pregnancy, 48 per cent yielded leukocyte counts between 4,500 and 10,000, 36.6 per cent were between 10,000 and 16,000, while 15.3 per cent showed a marked leukocytosis of between 16,000 and 36,350, and concludes

that the leukocytes fluctuate rapidly and markedly according to the amount of fresh blood thrown into the peritoneal cavity.

9. X-ray. Occasionally a diagnosis may be made brilliantly by the x-rays. After ten weeks' duration of the pregnancy, a deposition of lime salts takes place and may cast a shadow; after five months, an embryo should usually be

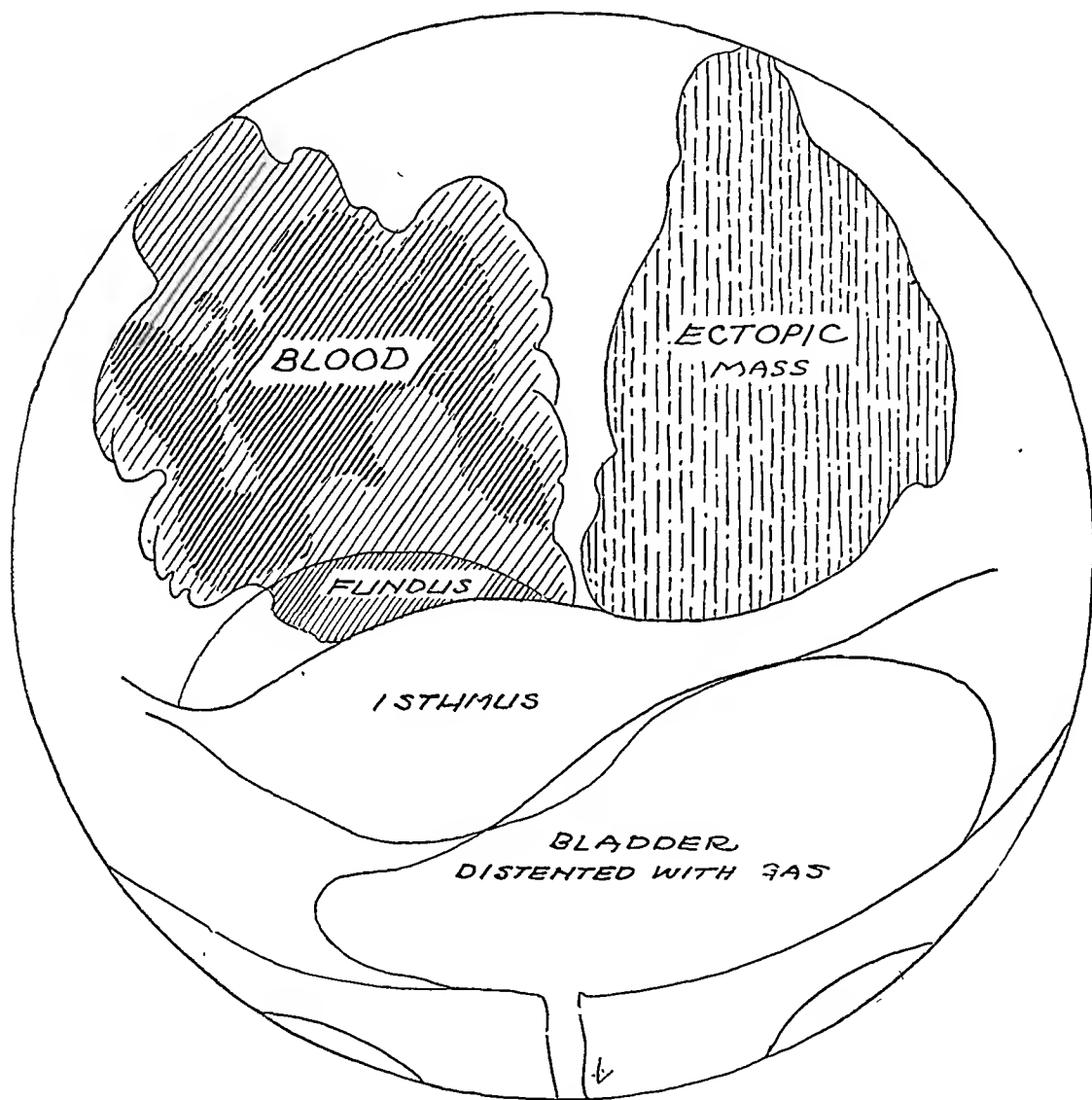


FIG. 573.—EXPLANATORY DIAGRAM OF ROENTGENOGRAM OF TUBAL PREGNANCY.
(I. F. Stein.)

demonstrable. Roy, Catlin, and others report skiagraphic demonstrations of extra-uterine fetuses before operation.

Catlin's patient (*J. Am. M. Ass.*, Jan. 12, 1924) is of more than ordinary interest. A primipara, aged twenty-nine, first seen by him October 24, 1922, had not menstruated since December 12, 1921, and was evidently pregnant. An x-ray examination, Figure 571, showed the fetus with its head at the costal margin and the feet in the left iliac fossa. At operation, November 1, 1922, a

dead $7\frac{1}{2}$ pound child was removed. The sac filled the abdomen and the placenta firmly attached to the abdominal wall to the left of the midline could not be removed immediately because of its extreme vascularity. The sac was sewed to the parietal peritoneum, packed, and the wound left open. A month later the placenta was detached, the wound speedily closed, and the patient made a good recovery.

Intraperitoneal inflation with carbon dioxid advocated by Reuben Peterson and others for the skiagraphic demonstration of pelvic tumors may be useful in establishing a diagnosis where an ordinary pelvic examination is difficult or impossible.

A woman of thirty came to I. F. Stein (*Surg., Gynec., & Obst.*, Jan. 1926, p. 83) complaining of uterine hemorrhage of four weeks duration. She was so obese that pelvic examination was unsatisfactory, eliciting nothing but tenderness and an impression of pelvic fullness. Subjective symptoms were indefinite, consisting in the main of vague abdominal pains, and there was nothing to suggest pregnancy. Transabdominal pneumoperitoneum was induced with a liter of carbon dioxid, and a roentgenogram of the pelvis was taken which showed a definitely circumscribed mass in the right pelvis, below which the cross section of the uterine isthmus and cervix can be identified with the gas-distended bladder in front. The left half of the pelvis is occupied by a shapeless, irregular, cloudy mass, quite characteristic of blood and clot in the peritoneum; the fundus of the uterus is completely obscured by the shadows. On the basis of these findings, laparotomy was done and a right tubal pregnancy was removed with about a pint of blood and clots.

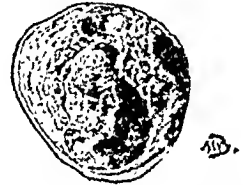


FIG. 574.—CROSS SECTION OF TUBAL WALL IN AMPULLA.

Placenta on left and blood clots on right choke tube, thinned out in neighborhood of clots. Operation. Recovery. $\times 1$.

The statement that the most typical thing about an ectopic pregnancy is that it is atypical is well borne out here, where uterine bleeding was the only clue aside from the skiagraphic evidence of the film after pneumoperitoneum.

Speaking broadly, one should entertain the possibility of an ectopic pregnancy in any woman who during the period of menstrual life complains of pain in the pelvis, if in addition to the pain there has been any change in the menstrual rhythm. Irregular bleeding is a commonly but not always associated sign. Polak in reporting on a series of 227 cases of tubal pregnancy states that 222 of them showed some form of abnormal menstrual flow.

Although the diagnosis can be made readily as a rule, occasional instances occur when the true nature of the malady is discovered only when the abdomen is opened and the uterine tube incised and found to contain laminated clots, Figure 574.

In our own series previously mentioned, a correct diagnosis was reached in 72 per cent. In these days of frequent operations for appendicitis, that con-

dition is often confused with an extra-uterine pregnancy. Such errors arise, as a rule, from a careless consideration of the history and a superficial examination. Errors will be fewer if, in examining, the surgeon notes the tendency of the appendical inflammatory process to extend out more into the iliac fossa, as well as the relatively higher location of the point of tenderness, with the occurrence of fever from the onset in appendicitis. Close attention, too, should be paid to a missed period. Careful vaginal and rectal examinations are most important in establishing the connection of the extra-uterine tumor with the uterus.

In examining the pelvis in suspected ectopic pregnancy, only gentle pressure should be made, as a rough manipulation might easily rupture a pregnant tube and cause a dangerous or even a fatal hemorrhage.

Many extra-uterine pregnancies are confused with incomplete abortions. In the latter as a rule the pain is less severe and the bleeding greater in amount. The presence of the tender lateral tumor in an ectopic case determines the diagnosis.

Finally, if the diagnosis is doubtful, it may, in rare instances, be well to make a posterior colpotomy, when if free blood is found an ectopic pregnancy is quite certainly present; then if the usual surgical precautions have been taken to sterilize the vaginal field, there is no contra-indication to an immediate laparotomy.

The first diagnosis of an unruptured tubal pregnancy was made in Germany by Veit in 1883 (*Die Eileiterschwangerschaft*, 1884) followed by Janvrin in America in 1886 (*Tr. Am. Gynec. Soc.*, 11: 471).

The first case of which I know, in which an unruptured pregnancy was recognized and operated upon in America, was one of my patients in Kensington, Philadelphia (*Tr. Obst. & Gynec.*, Baltimore, Jan. 14 and Feb. 11, 1890).

The diagnosis was made and the operation, March 20, 1886, revealed a right-sided unruptured sac, 10.5 centimeters long, developed in about the middle of the uterine tube. The sac was cut open and extruded a shrunken but well-formed male fetus, 12 centimeters long from vertex to rump. The patient recovered and became normally pregnant the following month, and I delivered her in January, 1887, with a difficult forceps operation.

The diagnosis may sometimes be impossible even with the pregnant tube in the fingers of a skilled surgeon. B. C. Hirst (*Am. J. Obst.*, 1905, 51: 539) reports such a case of an overlooked extra-uterine pregnancy. In the course of an operation for some pelvic condition the uterus and appendages were carefully inspected and palpated and nothing abnormal found. After three and a half weeks the patient returned home and in about two days the hospital resident was hurriedly summoned to find a ruptured extra-uterine pregnancy. The ovum, about four weeks old, had been in the tube when Hirst had it in his fingers.

When advanced the difficulty is not so much the recognition of a preg-

nancy as the decision whether it is extra- or intra-uterine. The situation is best clarified by anesthetizing and grasping the cervix with forceps and carefully drawing down the uterus toward the vaginal outlet while feeling its outlines through the rectum. If the entire uterus can be distinctly outlined in this way, the ovum is clearly extra-uterine. Error is more apt to arise in confusing a normal with an extra-uterine pregnancy. With scant amniotic fluid and uterine walls thinned and almost like wet blotting paper, the first impression of an extra-uterine pregnancy through thin abdominal walls is almost irresistible; a skillful vaginal and bimanual examination almost invariably at once corrects the error. It must not be forgotten that an extra- and an intra-uterine pregnancy may be present at the same time. The milk in the breasts and the linea nigra are present in the extra-uterine as well as in a normal gestation.

A pregnancy in one horn of a bicornate uterus will be distinguished by the lopsided shape of the enlarged unimpregnated horn, as well as by the low, broad connection of the sac with the cervical end of the uterus.

A goodly percentage of ruptured extra-uterine pregnancies sooner or later become infected and form pelvic abscesses. If the disease has been previously unsuspected the presence of old blood-clots evacuated with the pus will at once prove illuminating, and the discovery of the villi will settle all doubts.

The diagnosis in a case of interstitial pregnancy is apt to offer considerable difficulties. From time to time I have observed a peculiar condition of the uterus in the early months of a pregnancy, terminating normally, which might easily be mistaken for interstitial extra-uterine. The softening and the enlargement of the uterus was always confined to one of the apices, or one half, leaving the rest of the uterine body firm and unchanged. The impression to the examining finger was that of a cyst from 5 to 10 centimeters in diameter up in one corner of the uterus. A remarkable feature is that this form is often associated with more or less severe pains. In seven instances I have been able to recognize the condition, and in each the sequel has proved the correctness of the opinion. In one case a physician brought his wife a long way for an operation, labeled extra-uterine pregnancy; she had a cystic growth in the left upper uterine cornu representing a five months' pregnancy, while the rest of the uterus below and on the right side was felt firm and unchanged. Her suffering had confined her almost constantly to bed. I gave my opinion that the pregnancy was intra-uterine of this apical form and would terminate normally, as it did in four months. The first one I ever saw was in the late eighties and close to delivery with the left half of the uterus undeveloped. In another, not feeling quite so sure, I opened the abdomen and discovered the tumor in the right apex about 9 centimeters in diameter with deep-red muscular walls, while the rest of the uterus was unaltered. The abdomen was closed and the pregnancy went on to a normal delivery.

If my interpretation of these cases is correct, this affords an explanation

of some of those reported as interstitial becoming intra-uterine. On the other hand, the objection may be offered that these cases are in reality interstitial pregnancies with an ovum simply lodged in close juxtaposition to the uterine cavity and so becoming intra-uterine with the increase in the size of the ovum.

The characteristics of this peculiar form of apical pregnancy are:

1. That one apex or one-half of the uterus enlarges and softens without the participation of the rest of the organ.
2. That this is most marked in the early months, but observable as far on as the fifth or sixth and even later.
3. That the condition is painful, the patient often complaining of suffering never felt in previous normal pregnancies.
4. That the pregnancy terminates normally.

A difficult case for diagnosis is one presented by T. S. Cullen, Figure 575, of a patient who had gone two weeks over her period and then had irregular bleeding and cramplike pains. The uterus was apparently about two months pregnant, with a tender, hard, nodular mass in the position of the left cornu,

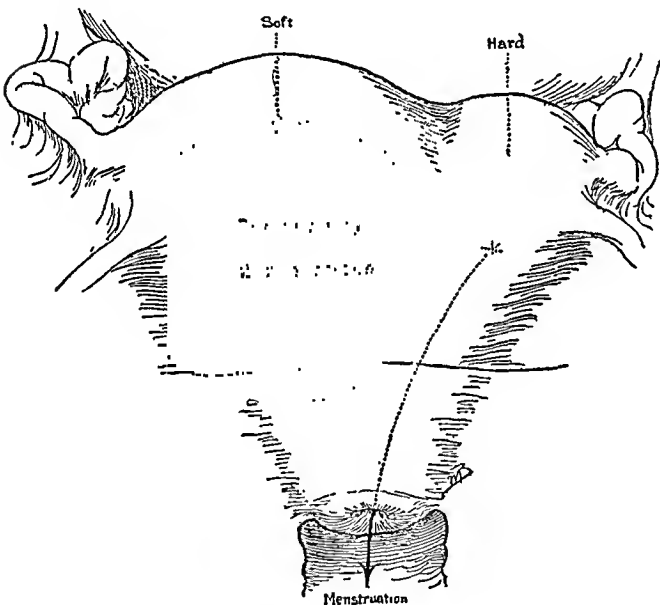


FIG. 575.—PREGNANCY IN RIGHT HALF OF SEPTATE UTERUS WITH HARD LEFT UTERINE BODY, ASSOCIATED WITH PAIN AND BLOODY DISCHARGE FROM LEFT SIDE, CLOSELY SIMULATING EXTRA-UTERINE PREGNANCY.

Abdomen opened to clear diagnosis. No further operation. Recovery. (T. S. Cullen.)

while the uterus was not tender at all. The cervix was softened. The case was considered to be an extra-uterine pregnancy in the left cornu with a uterus sympathetically enlarged. In view of the doubt, a small abdominal incision was made and through this appeared the uniformly enlarged right uterus, bluish in color, soft, and cystic. The enlargement extended down on the right side to include the lower part of the uterus. Between the right and left sides was a shallow sulcus.

J. Haldan draws attention to an important diagnostic sign of a pregnancy in a bicornate uterus; namely, a

strong cord stretching from the middle between the horns across to the vertex of the bladder. In Haldan's case this was about as thick as the round ligament and, from its position and direction, not unlikely to be mistaken for any other structure. In pregnancy it is drawn upward in proportion as pregnancy advances and can be felt in an external examination.

The hemorrhage in extra-uterine pregnancy is one of its most characteristic features and may be due to the erosion of the maternal vessel by the Langerhans cells associated with the active invasion of the tissues by the ovum. A rupture of the vessels may occur in this way in several places. A serious and fatal hemorrhage has been noted after the death of the fetus, due to the detachment of the ovum from the tubal wall or to a tear in the wall of a tube unable to accommodate the growing ovum. The hemorrhage may take place into the

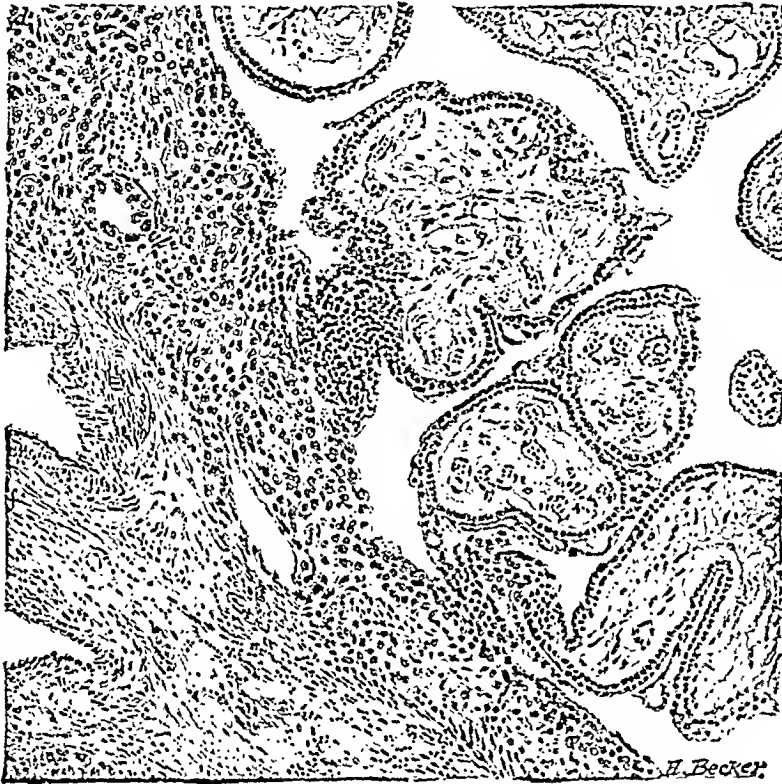


FIG. 576.—SECTION FROM WALL OF TUBAL PREGNANCY TAKEN FROM COLLECTION OF F. P. MALL.

Right half of figure shows islands formed by chorionic villi made up of myxomatous stroma with two outer limiting epithelial layers, innermost, Langerhans, and outermost, syncytial layer. Left half of figure shows tubal wall with some large vascular spaces. Large triangular area in lower left corner shows fibromuscular tissues with slight round-cell infiltration. Between this layer and villi lies decidual layer. Large decidual cells seen in all parts of this portion. $\times 100$.

extra-uterine sac itself or into its walls, into the lumen of the tube, or into the abdominal cavity, or between the peritoneal layers. Hemorrhage into the tube and by its fimbriated end out on to the peritoneum, and hemorrhage due to rupture of the tube into the abdominal cavity, are the chief clinical varieties. Hematocoele, an intraperitoneal accumulation of blood due to rupture or the casting off of the extra-uterine product, may be encapsulated behind, at the side of, or in front of the uterus. When not encapsulated, it is diffuse, spreading throughout the pelvis and sometimes even filling the abdomen.

The relation of the chorionic villi to the tubal wall is shown in Figure 576,

in which the striking feature is the layer of decidual cells replacing the normal mucosa between the villi and the fibromuscular elements in the wall. It has been clearly shown that the lodgment of the embryo is not passive but that, on the contrary, when it ceases to wander it burrows actively through the mucosa into the subjacent tissues, destroying the maternal cells as it advances. This process of erosion ("usur") is the cause of the perforation of the tubal wall and fully explains the excessive hemorrhage often found in some early isthmic cases, Figure 577.

In a case of my own, a right isthmic pregnancy, no period had been missed when she was suddenly seized with violent pain, interpreted as colic from

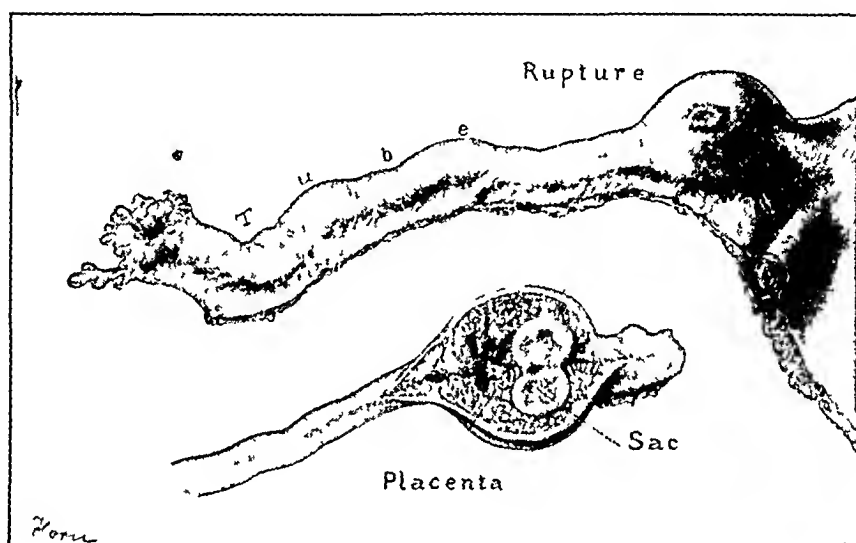


FIG. 577.—TUBAL PREGNANCY.

Erosion and hemorrhage at point indicated. Uterus shown attached to exhibit relative position of tube. Lower part of picture shows tube laid open, containing a little ovum in the midst of a mass of placental tissue. Tense abdomen contained about $2\frac{1}{2}$ liters of blood. Operation. Recovery. (T. S. Cullen.) $\times \frac{1}{10}$.

indigestion, and bled to death in two days from a nodule about as big as a bean (1 by 2 centimeters) ruptured on the dorsum.

After the rupture, the fetus may escape into the abdominal cavity and continue developing. The usual course, however, is the fetal death and an extensive mass of clots often walled off from the upper abdomen by intestinal adhesions.

It often happens that the very first hemorrhage, even as early as the second month, proves fatal. On the other hand, death may come from anemia after a succession of hemorrhages.

The amount of hemorrhage depends upon the position of the rupture, and whether or not it happens to involve a large blood-vessel; it is particularly dangerous when it lies in the placental site. Repeated hemorrhages occur when there is a partial rupture and a growing ovum. The hemorrhage is often checked temporarily by a clot or by tufts of placental villi; it is not so likely

to prove fatal when it is between the layers of the mesosalpinx, opening up the broad ligament and lying under the pelvic peritoneum.

Some of the most frightful hemorrhages are in isthmal cases in a perforation by erosion in the embedding of the ovum, as in Figure 577, where the monthly period was only two weeks overdue. While in the act of throwing a twig over a fence, the patient, twenty-two years old, was seized with intense pain in the left ovarian region and soon became so blanched and weak that any attempt to move her brought on a fainting spell. On opening the abdomen $2\frac{1}{2}$ liters of blood were removed. A small corpus luteum cyst was found in the right ovary which was resected. The left tube and ovary appeared normal but a searching examination revealed a bulging spot on the tube 3 millimeters from the uterus and a little bluish red mass in it only 1.5 centimeters in diameter. Posteriorly there was a little opening from which blood was slowly



FIG. 578.—EXTRA-UTERINE PREGNANCY.

Rupture in ampulla and escape of fetus, still attached by cord; ovary is intact below sac. Operation by Peck of Youngstown, O. Recovery. $\times \frac{1}{2}$.



FIG. 579.—RUPTURED LEFT EXTRA-UTERINE PREGNANCY WITH LARGE, FREE INTRAPERITONEAL HEMORRHAGE.

Rupture at junction of ampulla and isthmus; rest of ampulla dilated and infiltrated down to a narrow neck just behind fimbriated end. Enucleation; saline infusion. Recovery. $\times 1$.

usually much less free. When the ovum, imbedded in the ampula, becomes detached early in the pregnancy, successive hemorrhages often accumulate about it, taking the shape of the distensible tube and forming an extra-uterine tube cast which resembles a sausage and is usually ragged at its

oozing. The left tube was removed and she recovered.

Sometimes the pregnancy terminates with the escape and death of the ovum, with the extravasation of blood into the peritoneum, followed by the entire absorption of the abnormal products. Such a case may be wrongly interpreted by the physician simply as a severe colic.

Fortunately more tubal pregnancies end by tubal abortion than by tubal rupture when, as stated, intraperitoneal hemorrhage is

outer end, projecting from the ampulla. Blood-casts may be found in the affected tube or amid a mass of clots in the peritoneal cavity.

Figure 581 exhibits a tubal abortion in which the ampulla is distended by black clots partly extruded at the fimbriated extremity; there was but little blood in the abdomen.

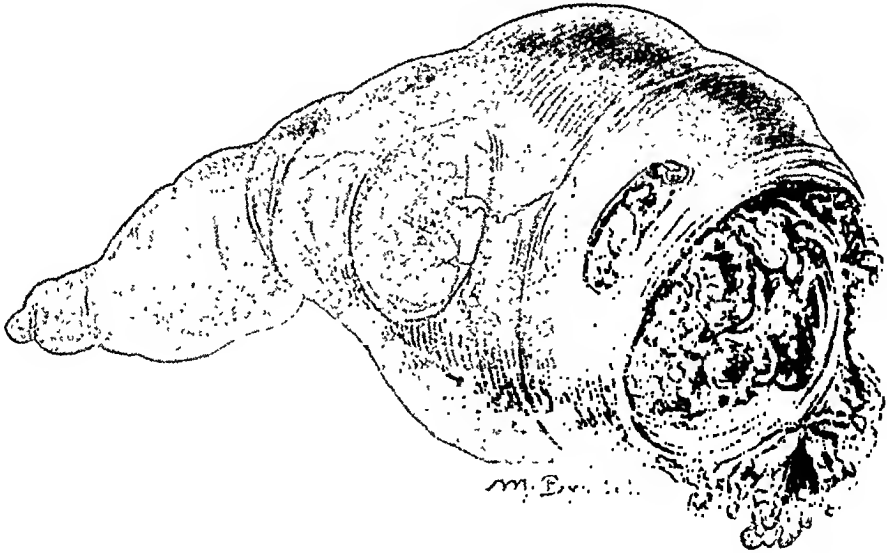


FIG. 580.—TUBAL ABORTION.

Bleeding checked by large coagulum distending and thinning out tube; fimbriated opening greatly distended, but greater diameter of clot in ampulla prevents its escape. Wall of tube averaging 1 millimeter in thickness. Operation. Recovery. $\times 1$.

Only in rare instances is there little hemorrhage with the tubal abortion when the fetus and its membranes are extruded *in toto* through the fimbriated extremity. In a specimen exhibited by G. Edebohls at the New York Obstetri-

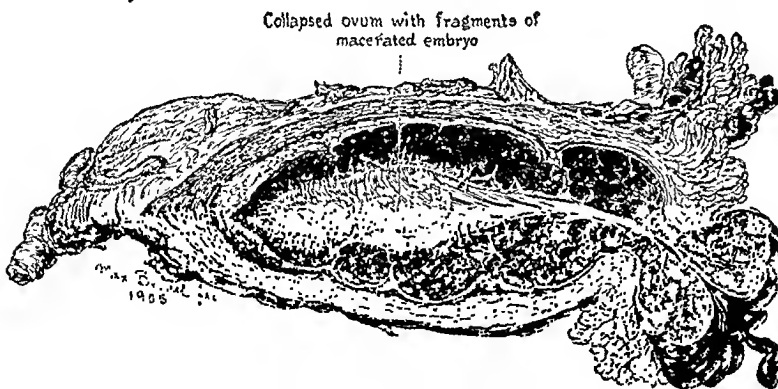


FIG. 581.—TUBE OPENED AND PARTIAL EXTRUSION OF CLOT.

Fragment of embryo seen in collapsed sac with villi and periphery radiating into clot. Operation. Recovery. $\times 1$.

cal Society, the fetus with membranes intact was in the process of abortion, one half of the ovum being free in the peritoneal cavity, while the other half was firmly grasped by the dilated, conical, fimbriated end of the tube, like a bud in its calyx.

A fetus extruded into the peritoneal cavity by rupture of the sac, dies, and the sac becomes walled off by adhesions. Later suppuration may occur, with perforation and discharge of the contents by the rectum, vagina, bladder, or abdominal walls.

A not infrequent termination of tubal pregnancy is the death of the fetus

in the intact tube, with marked hemorrhage about it and between its membranes. At the same time the liquor amnii is absorbed, the blood more or less organized, and a structure produced identical with the moles found in uterine pregnancy. Such moles vary in size, according to the age of the pregnancy and the amount of the hemorrhages, and may lie in the tube indefinitely.

When pregnancy is in that part of the tube which lies within the uterine wall, the growing ovum may gradually become extruded into the uterine cavity, while the placenta retains its connection with the sac within the cornu where it may be found and removed after the delivery of the child in the natural way.

Interstitial pregnancy is peculiarly liable to rupture into the abdominal cavity with an immediately fatal hemorrhage, or else it may rupture into the layers of the broad ligament.

It is important to bear in mind that not all hematocles or accumulations of blood in the uterine tube denote a co-existing extra-uterine pregnancy.

C. Schambacher ("Weiterer Beitrag zur Frage der vorgetäuschten Extra-uterin-Gravidität," *Centralbl. f. Gynäk.*, 1903, 27:1081) cites several instances independent of this source; as for example:

1. In disturbances of circulation consequent upon a fatty heart, in which a posterior colpotomy showed that the uterine adnexa were normal.

2. At an operation several weeks after normal parturition, where both tubes were much thickened with bloody exudates in their lumina and there were no traces of fetal structures.

3. In a virgin with peritoneal tuberculosis where the left adnexa were agglutinated into a mass with the intestines and free blood was found between the adhesions and in Douglas's culdesac.

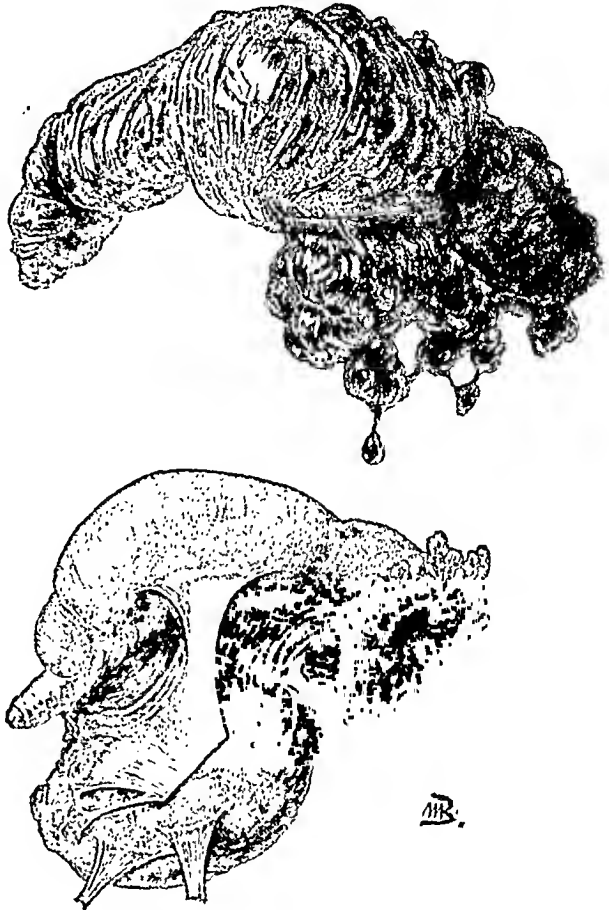


FIG. 582.—EXTRA-UTERINE PREGNANCY.

Thickened tube and adhesions between tube and ovary. Black mass above tube a blood-clot forming perfect tube cast found thrown off into abdominal cavity. Operation. Recovery. $\times \frac{1}{4}$.

4. In an infantile bipara of twenty-one years of age, left hemorrhagic salpingitis, with a right tube chronically thickened; at a later date pulmonary tuberculosis.

He concludes that vascular disturbances either general or local may cause hemorrhages into the abdominal cavity, whose origin sometimes cannot be determined; he further lays stress upon menstrual engorgements or frequent recurring hyperemias in infantile organs which may lead to inflammatory conditions and finally to hemorrhages into the tubes.

Pelvic intraperitoneal hemorrhage again may be due to a rupture of one of the large veins so often found with fibromyomata of the uterus. We recently saw an interesting instance of this sort. A colored woman of thirty-seven was admitted to the Grace Hospital, New Haven, January 1, 1926, complaining of the sudden advent of a lower abdominal pain for two days, at times severe and causing her to vomit. For years there had been a menorrhagia but no intermenstrual bleeding and no pelvic pain. There was no history of injury. The pain was worse in the right iliac fossa and severe in the epigastrium. Temperature was normal but the blood showed a leukocytosis of 21,000. Examination revealed a multinodular uterine fibromyoma reaching to the umbilicus, with a slight tenderness over the entire lower abdomen not specially marked at McBurney's point. However, the diagnosis of fibromyoma of the uterus with a possible appendicitis stood. At the operation, A. N. Creadick found about a liter of bright fluid blood and old blood-clot in the pelvis and lower abdomen. There was no evidence of ectopic gestation or other abnormality, but a careful search revealed a large ruptured vein bleeding freely beneath a subserous myoma in the right uterine cornu. After a hysteromyomectomy, careful investigation of the other viscera revealed no other possible source of bleeding. The recovery was uneventful.

The recent intraperitoneal hemorrhage explained the leukocytosis and without doubt the severe referred epigastric pain.

The normal rupture of a graafian follicle is probably accompanied by the escape of a few drops of blood at the site of the rupture; however, occasionally a free or even fatal intra-abdominal hemorrhage may occur in this way (W. P. Graves, *Gynecology*, 3d edition).

To recapitulate, unless artificially relieved, extra-uterine pregnancy always terminates fatally to the child and is frequently fatal to the mother.

The following is a categorical statement of final results:

1. Development of the fetus within the tube, with false labor and death of the fetus which is retained as a lithopedion, or is mummified, or discharged with suppuration
2. Tubal abortion
3. Tubal mole
4. Extrusion into the uterus (in the interstitial form) and development to term

5. Rupture within the folds of the broad ligament, usually with the death of the fetus, in rare instances advancing to term
6. Rupture into the peritoneal cavity followed by:
 - (a) Continued growth of the fetus
 - (b) Death of fetus and mother
 - (c) Death of fetus alone with absorption
 - (d) Death of fetus with a succession of hemorrhages ending in:
 - (1) Suppuration, peritonitis, and maternal death
 - (2) Suppuration and discharge externally by the rectum, by the vagina, by the bladder, or by the abdominal walls

Chorio-Epithelioma of the Uterine Tube.—Chorio-epitheliomata of the fallopian tubes are not extremely rare. Usually the tumor develops in a tube, the site of an extra-uterine pregnancy. Subsequent to a tubal pregnancy, as also in such tumors after a normal intra-uterine pregnancy, a distant focus may be primarily affected. Tubal chorio-epithelioma may be secondary to a primary intra-uterine growth or primary following a tubal pregnancy. Leipman has collected eighteen primary tubal chorio-epitheliomata up to 1914.

The first announcement of the discovery of this entity was made by M. Säger at the German Gynecological Society at Leipzig in 1888 (*Centralbl. f. Gynäk.*, 1899, 13:132).

Multiple Pregnancy.—There are numerous observations of a coincident extra- and intra-uterine pregnancy.

The course under such circumstances may be that of an extra-uterine pregnancy with death of the fetus, followed later (it may be several years later) by an intra-uterine pregnancy, when the uterine pregnancy may either go on to term or terminate prematurely in abortion. When the extra-uterine pregnancy is recent, the importance of recognizing both conditions is manifest. Hanna Christer-Nilsson (*Mitt. a. d. gynæk. Klin. d. . . . O. Engström in Helsingfors*, 1903, 4:1) collected sixty-eight cases from the eighteenth century on.

H. Bichat states that in fifteen out of forty-nine, the development of a tumor in the course of a pregnancy was noted. Not infrequently there is a rupture of the extra-uterine sac, occurring usually within the first four months and often followed by a uterine abortion, after which a tumor is discovered at the side of the uterus.

From the fourth month on the diagnosis is easier to make because the tumors are more definite and distinct. In twelve out of forty-nine, the uterine pregnancy went to term.

The treatment in a rupture of the sac is laparotomy as soon as the double pregnancy is detected.

A successful operation, removing an extra-uterine ovum without interfering with the intra-uterine pregnancy, is reported from Fritsch's clinic by

Reifferscheid. The intra- and the left-sided extra-uterine pregnancy had both probably occurred simultaneously. The patient who considered herself pregnant had first an uncomfortable sensation in the left side, then repeated attacks of severe pain with loss of consciousness. The examination showed a uterus about three months pregnant, while on the left side there was a soft tumor the size of a goose's egg not distinctly outlined. The abdomen was opened and a left tube and ovary with a mass of clots removed with extreme care. An embryo about 1 centimeter long was found. The uterine pregnancy then advanced uninterruptedly. Similar cases have been successfully treated by V. Ott, Hermes, and Mond.

Where the extra-uterine pregnancy has gone on toward the end of pregnancy and a coincident intra-uterine pregnancy exists, the extra-uterine child may be saved by operative interference and the intra-uterine pregnancy successfully terminated by a cesarean section.

N. J. Hagens and J. J. Moorhead (*J. Am. M. Ass.*, 40:1440) report one instance in which they made "a diagnosis of extra-uterine with probably intra-uterine pregnancy." The treatment was by an incision posterior to the cervix, and the extraction of an ectopic fetus and placenta. The free hemorrhage was controlled by gauze packing. Twenty hours later a second placenta and fetus measuring 12 centimeters from vertex to rump issued from the uterus. The extra-uterine fetus was 10 centimeters long. Out of eighteen (Gutzwiller), ten maternal lives were lost; of the remaining eight, four were saved by celiotomies. In one, both children were delivered living, but the mother died. In his own case, the extra-uterine pregnancy advanced to the eighth month when the fetus died from injury, and the intra-uterine pregnancy occurred shortly afterward; twelve months after the beginning of the extra-uterine pregnancy it was discovered and removed, and on the second day after, a three months' fetus escaped from the uterus.

Spencer Wells made a diagnosis of simultaneous extra-uterine and intra-uterine pregnancy in a case in an enlarged pregnant uterus with a tumor attached, by hearing both fetal heart sounds.

In a patient under the care of A. L. Galabin, there were two fluctuating tumors separated by a distinct sulcus, one on the right reaching to the ribs and one on the left in the inguinal and iliac regions. Fetal movements and heart sounds and a uterine souffle were heard only on the left side; in the right tumor a hard body was felt through the fluid; a significant point was the fact that the patient began to complain suddenly of great pain and faintness and developed a marked peritonitis. The diagnosis then lay between a ruptured ovarian cyst and an extra-uterine fetation combined with an intra-uterine one; the latter was found.

Twin tubal pregnancies are not very rare. More than fifty have been reported. They may involve one or both tubes and the embryos may be of the

same or different ages. Lockyer in 1916 found thirty-five instances of bilateral tubal pregnancy reported.

C. Fenger found two ova in the same tube, and Max Sänger (*Centralbl. f. Gynäk.*, 1893, 17: 148) reported a triplet extra-uterine pregnancy in a woman of thirty-two who had had a severe peritonitis after a labor four years before. At the operation, undertaken for the progressive anemia, associated with cessation of menstruation, Sänger found a left multilocular ovarian cyst the size of two fists and near to this an encapsulated hematocele communicating with the right tube. The left tube and cyst were removed, the hematocele cleaned out, and the right tube and ovary removed. The right tube for its outer two-thirds looked like a piece of intestine and was full of clots. Sänger then enucleated from the right side of the fundus uteri an intramural twin ovum looking like a fibroid tumor the size of an apple, without opening either the cavity of the uterus or the tube. The tubal wall in the neighborhood of the abdominal ostium showed a thin layer of decidual cells extending down to the muscularis, while the intramural twin ovum showed two complete and perfectly separated amnia. The age of the twin ovum was estimated at three to four weeks. There are numerous reports of extra-uterine pregnancies in both tubes simultaneously.

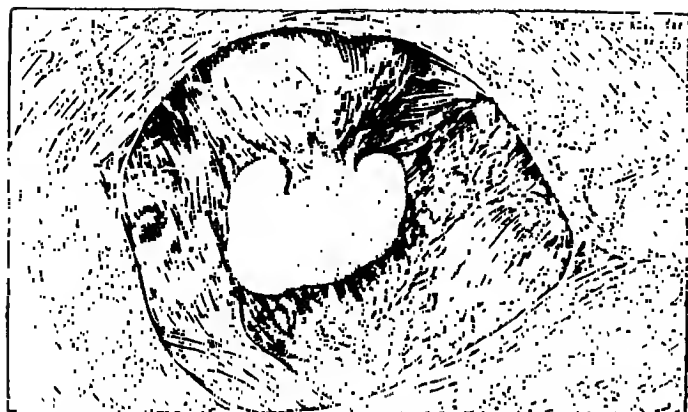
Krusen (*Am. Med.*, 1902, 3: 18) reports a woman, thirty-four years old, who died of peritonitis, with a ruptured right tubal pregnancy where three fetuses were found, while the left tube was inflamed and adherent but intact. The fetuses seemed to be in the second month of gestation.

Repeated Extra-uterine Pregnancies.—Many cases are recorded of an extra-uterine pregnancy occurring twice in the same woman. Brady, for example, in analyzing the reports of fifty consecutive tubal pregnancies in the Johns Hopkins Hospital found two with previous operations for the same condition. In the Yale Woman's Clinic in a like series of fifty, five had had previous operations for an ectopic pregnancy. In one, only six months intervened between the two operations. There is no record of the subsequent histories of the other forty-five; presumably some have had or will have a recurrence.

R. R. Smith reports that among 1,608 tubal pregnancies operated upon by members of the American Gynecological Society, fifty-eight or 3.6 per cent had subsequent extra-uterine pregnancies (*Tr. Am. Gynec. Soc.*, 1911, 36).

Grouping the statistics from various authors, Schumann concludes, "that among 280 patients in whom future pregnancy of any variety was possible, 35, or 12.5 per cent, suffered from repeated ectopic gestation, while 134 intra-uterine pregnancies occurred, or 47.8 per cent, a ratio of about 1:4. It appears then that about one woman in eight who has had one extra-uterine pregnancy may expect another. Whereas, about one half the number have the possibility of a future normal pregnancy."

Fetal Abnormality.—F. Mall (*Surg., Gynec., & Obst.*, Sept. 1915) in summarizing the results obtained in the examination of eighty tubal pregnancies reports 16 per cent as containing normal embryos, 25 per cent pathological embryos, and 50 per cent pathological ova. Of twenty-five pathological ova only six were ruptured, showing that ruptured specimens usually contain normal embryos. In other words, a live normal embryo is probably far more dangerous to the mother than a pathological one. Mall quotes von Winckel's findings in eighty-seven ectopic pregnancies of which fifty-seven contained much-deformed fetuses and twelve were monsters. As a rule, if a tube contains a pathological embryo, evidence of marked inflammatory change will also appear. With a normal embryo there is but little tubal inflammation. In other words, if the inflammatory lesion in the tube is nearly healed, the ovum after implantation may develop and grow normally. If, on the other hand, there are still marked pathologic changes in the tube, abnormality of the embryo is likely.



Membranes opened, showing pathological embryo.

FIG. 583.—ABNORMAL FETUS.

Misshapen embryo seen walled in by hemorrhages.
Cranial end to left. $\times 7$.

It is the exception rather than the rule to find the embryo at operation, as the fetus has often been absorbed before the advent of the surgeon.

Treatment.—General.—On account of the imminent danger to the mother, an extra-uterine pregnancy in the early months must be looked upon and treated much as a malignant growth (Werth); it is only after the sixth month of pregnancy, when the fetus becomes viable, that it has any claim to consideration. The proposal to defer the active treatment of an extra-uterine pregnancy in its early stages in the interests of the child is simple sentimentality and untenable.

Plans of treatment differ so widely early and late in the pregnancy that we must necessarily deal with them separately. In the first six months, the sole important practical consideration is how best to remove the abnormal products at the earliest possible moment before any excessive hemorrhage has taken place.



FIG. 584.—FETUS AND UMBILICAL CORD FOUND LYING AMONG CLOTS IN ABDOMINAL CAVITY. $\times 1$.

Operative.—As a rule when the diagnosis of an ectopic pregnancy has been made, operation should follow immediately. Formerly if a patient was badly shocked and had a rapid pulse and low blood-pressure, many surgeons preferred to wait hoping that the bleeding would stop and the patient rally at least temporarily. When in examining we suspect a possible ectopic pregnancy, unusual care and gentleness of palpation must govern our actions; serious intra-abdominal hemorrhages have often resulted from rough manipulations. In one coming under our notice, a diagnostic curettage of the uterus was done and as a result of the manipulations the sac was ruptured and the patient died before an operation could be done.

At present most surgeons observe the rule of immediate operation.

When the intra-abdominal hemorrhage has been so great as to justify serious anxiety, blood transfusion preparatory to operation becomes a life-saving measure. In a modern hospital but little time is lost in testing the bloods of prospective donors and determining compatibility or incompatibility with the patient. In many institutions typed donors with Wassermann reactions determined are available for immediate call in emergency. With no serious cross agglutination to contra-indicate the use of the husband as donor, his blood may ordinarily be used without a Wassermann test if the need of transfusion is urgent.

Generally speaking, 500 to 1,000 c.c. of citrated blood are used, when as a rule the signs of anemia vanish rapidly, the quality and rate of the pulse and the blood-pressure approach the normal, and a hazardous operation is converted into one with but little risk. Citrated blood may also be given intravenously with great advantage one or more times after operation if the hemorrhage has been severe.

A patient in the Woman's Clinic at Yale furnishes an excellent example of the possibilities when citrated blood is used in transfusion before operation. The case was one of a ruptured right tubal pregnancy admitted to the hospital January 9, 1923, in severe shock, with the characteristic signs of serious intra-abdominal hemorrhage. The pulse beating 136 per minute was weak and thready; the blood-pressure reading, systolic 80 millimeters, diastolic 64 millimeters. Her husband's blood proving compatible, a citrated transfusion of 500 c.c. was given at once. Her condition improved immediately, the pulse becoming slower and of better quality, and within an hour the blood-pressure reached, systolic 150 millimeters with a diastolic of 84 millimeters. A laparotomy was performed immediately; recovery was uneventful.

Cornell (*Surg., Gynec., & Obst.*, May, 1913) reports an ectopic gestation transfused by the direct method the day after operation with about 750 c.c. of blood, and in his opinion the transfusion turned the balance from failure to success.

If a suitable donor is not available, the patient may furnish her own blood by autotransfusion, as proposed by Thies, the free blood found in the peritoneal

cavity being mopped up and citrated or returned with Ringer's solution into the circulation; after filtration through gauze the injection is made into one of the arm veins.

During the World War, autotransfusion was frequently used in hemothorax, injuries to the liver or spleen; etc., where spilled uncontaminated blood was available, with eminently satisfactory results.

Lichtenstein (*Arch. f. Gynæk.*, 1918, 109) reports handling thirty-eight tubal pregnancies since July 30, 1914, without a death; in seventeen, auto-

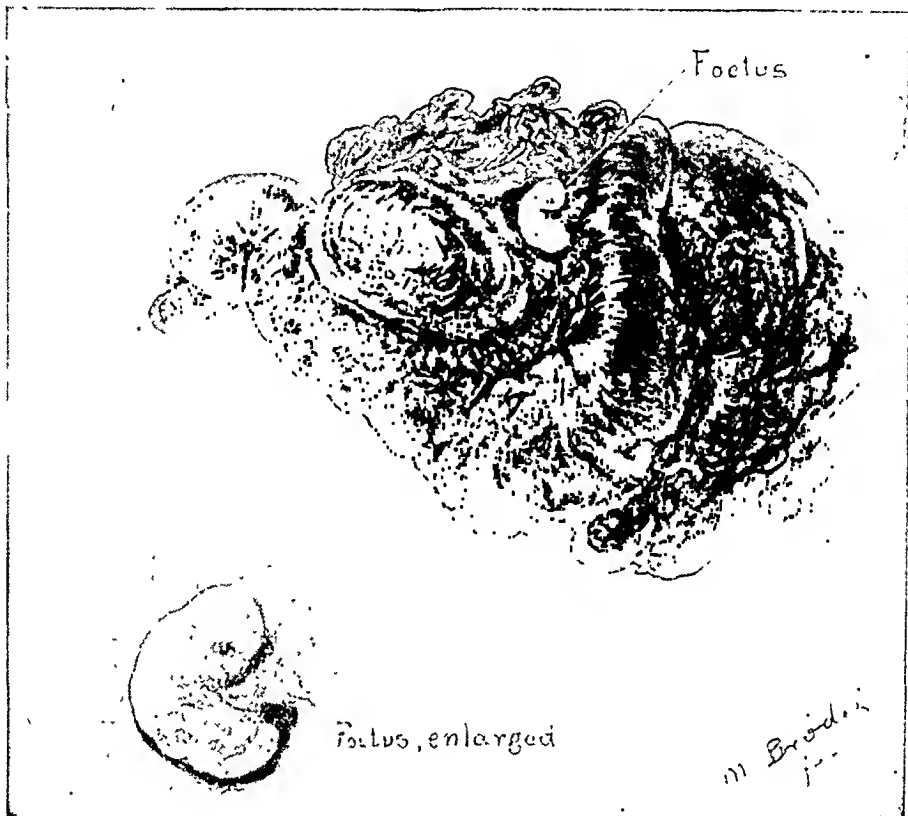


FIG. 585.—COAGULUM TURNED OUT.

Cast of tube extending up into isthmus. Fetus lies on surface. $\times 1$.

transfusion was done. A case of ruptured uterus was treated similarly. In one instance, 1,100 c.c. of blood were added to 650 c.c. of Ringer's solution and returned into one of the veins of the patient's arm.

To transfuse with safety, the blood from the peritoneal cavity must be sterile and not coagulated and the red cells must be intact; in old spent blood the latter may not be the case.

Schweitzer (*München. med. Wchnschr.*, June 10, 1921) reports that in Zweifel's clinic since January, 1919, thirty-four tubal pregnancies have come under observation and at operation twenty-one were treated by autotransfusion with but occasional slight difficulties resulting.

A. N. Creadick reports three extra-uterine pregnancies treated satisfactorily by autotransfusion in the Woman's Clinic at Yale.

With rare exceptions an *abdominal operation* is safer and better than a vaginal section. Through an adequate abdominal incision the pelvic organs are better exposed and examined and the extravasated blood and clots more readily and thoroughly removed, while, the chief indication, the rapid control of the hemorrhage is more speedily fulfilled.

When the abdominal incision is almost made, if there is free blood in the abdomen, a dark discoloration of the peritoneum and the preperitoneal fat often confirms the diagnosis of intraperitoneal hemorrhage, due generally to an ectopic pregnancy. When the hemorrhage has been great, the blood may spurt several feet in the air (or as Joseph Price used to declare, hit the ceiling) the moment the opened peritoneum releases the intra-abdominal tension.

If active bleeding has ceased and the patient's condition is good, time may be taken to expose and examine the pelvic structures in detail before proceeding with the operation which then becomes the counter-

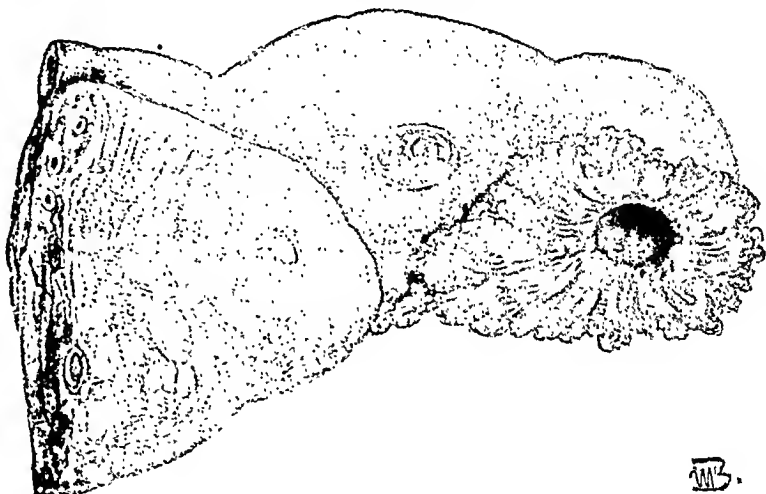


FIG. 586.—TUBAL ABORTION.

Inside of tube covered with laminated blood-clots, some of which adhere to wall, averaging 2 millimeters in thickness. Peritoneal surface of tube coated with cylindrical epithelium. No placental villi found. Corpus luteum in same ovary. $\times 1$.

terpart of a salpingectomy for hydrosalpinx. If bleeding is free, the operator quickly throws out a handful or two of clots and as quickly determines by touch in which tube the pregnancy lies and clamps the broad ligament on the uterine and outer sides of the tube and so controls its blood supply. The removal of the tube then follows its interstitial portion more leisurely.

An active hemorrhage from the sac wall has been controlled temporarily by compressing the aorta. It is important to save the ovary of the affected side as well as its fellow whenever possible.

Fluid blood should now be aspirated or sponged away and all clots removed if time is not too precious.

Vaginal or abdominal drainage is not advisable in the absence of secondary infection.

Whether to remove both tubes or only the one affected is a question for individual consideration and judgment at each operation. If the opposite tube shows any inflammatory process, its removal is always indicated. If one tube

is left, we know that from a third to a half of our patients will have a subsequent normal pregnancy, while on the other hand about 15 per cent will later have ectopic pregnancies (R. R. Smith). Such factors as the age of the patient, the size of her existing family, and her desire for children must help determine the decision.

J. A. Sampson believes that a bilateral salpingectomy combined with a supravaginal hysterectomy is often advisable. If there is an extensive inflammatory condition on both sides, removal of the uterus and adnexa by bisection of the uterus after the method of Faure-Kelly is the easiest and safest procedure. The anesthesia should be short and no time should be lost through-

out the operation. Blood and clots should be set aside, washed, and examined for the embryo or its remnant. Occasionally, a minute body, best recognized by a black speck—the eye, Figure 585—will be present. Again, little flesh or broken fragments represent the diminutive fetus as in Figure 587.



FIG. 587.—BITS OF LITTLE FETUS REMOVED AND FOUND CONCEALED IN CLOTS.

Means of recognizing head was little piece of flesh with black spot indicating eye. $\times 1$.

The *avenue of approach through the vagina* by the posterior culdesac, is only to be used in preference to the abdominal route and with advantage in long-standing, infected, suppurating hematoceles. After making a horizontal —, or a T-shaped incision, opening the pouch, and thoroughly evacuating the accumulated clots, cigarette drains are left in place to secure continuous free drainage. Hematomata between the layers of the

broad ligament are also best treated in this way. Recent extra-uterine pregnancies ought not to be approached by this avenue on account of the high risk of hemorrhages.

After Care.—The after treatment of extra-uterine fetation does not differ from other abdominal operation. A régime of quietude is imperative after the operation, and in case of shock the foot of the bed should be elevated and stimulants given, not omitting the best stimulant, a direct or citrated blood transfusion, when the matter is urgent. If for any reason blood is not available, 500 c.c. of normal salt solution should be injected into the cellular tissue under each breast, or run slowly into one of the arm veins.

Advanced Extra-uterine Pregnancy.—In advanced extra-uterine pregnancy, the treatment differs according as the fetus is living or dead; and the operator has to deal with a still active placental circulation or with one plugged by well-organized thrombi. So long as the circulation in the placenta continues, the operation may be fraught with danger from the excessive hemorrhage which follows every effort at detachment. When the placental site is on the tubal or abdominal wall, the uterus, or broad ligament, it may be possible to control hemorrhage by ligating the large vessels entering the sac, or by passing ligatures deeply into the surrounding tissue all around the site of attachment.

Should the vascularity of the placenta or the site of its attachment render immediate removal hazardous, two courses are possible. In both the cord should be ligated short and divided.

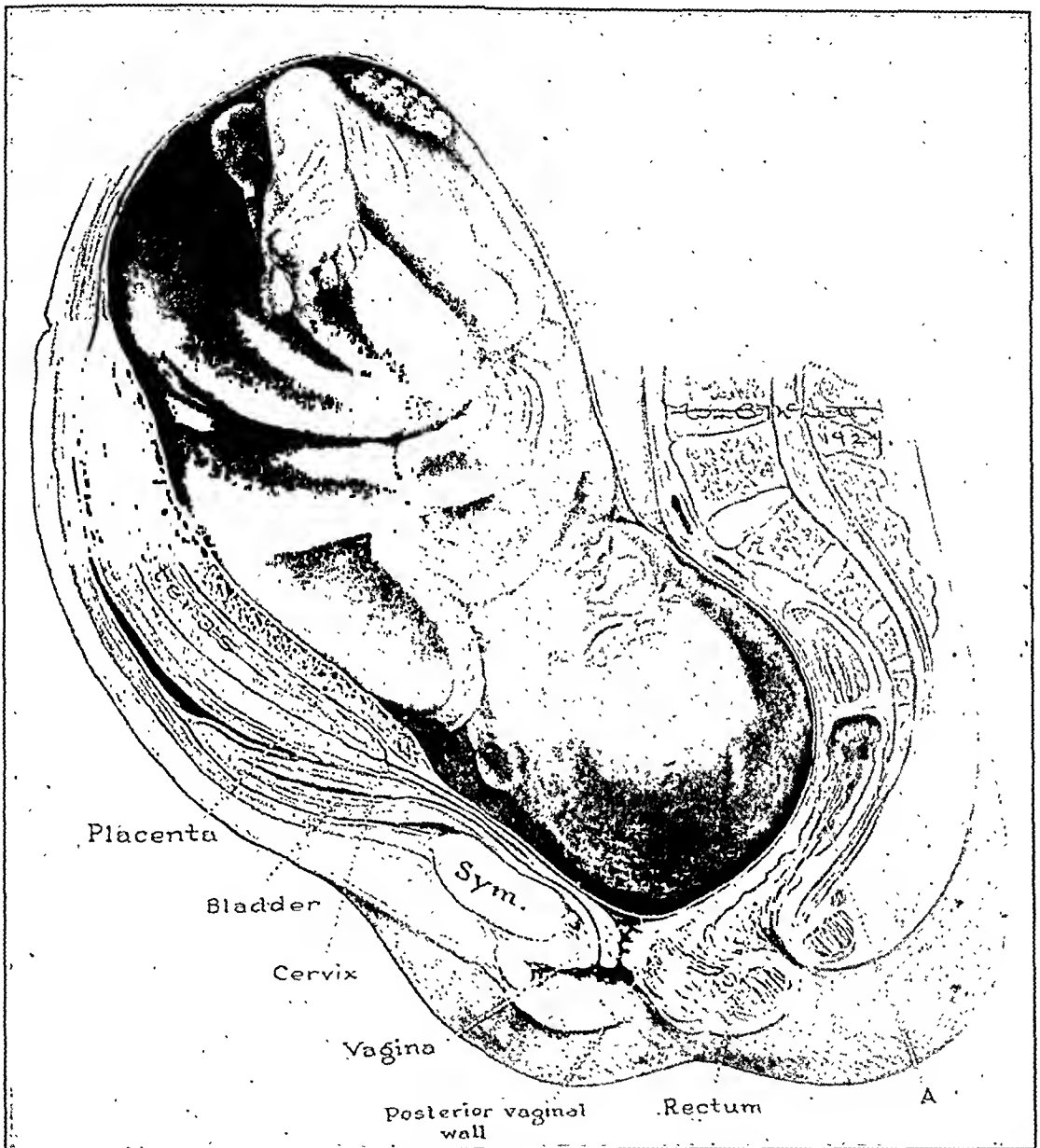


FIG. 588.—FULLY DEVELOPED EXTRA-UTERINE FETATION.

Placenta attached to posterior surfaces of broad ligaments and uterus flattened out in front. Head of fetus in extremely thin sac pressing down on pelvic floor near outlet. Body of uterus much enlarged. Peritoneal reflection at A. (J. M. H. Rowland.)

We may leave the placenta *in situ* and close the aseptic abdomen trusting to its absorption, a method which has been used successfully. The mass of foreign protein material is, however, so great that one hesitates to advise such a measure.

A better plan consists in suturing the edges of the sac to the parietal peritoneum (marsupialization) at the site of the incision and packing the cavity with gauze drainage, when in due time the placenta will separate and discharge piecemeal or *in toto* without the risk of hemorrhage. In J. J. Catlin's case, placental separation took place in four weeks. In spite of this delay, there was no postoperative hernia.

When the extra-uterine fetus has been dead for several weeks and the placental bruit has disappeared, the gravity of the operation in the absence

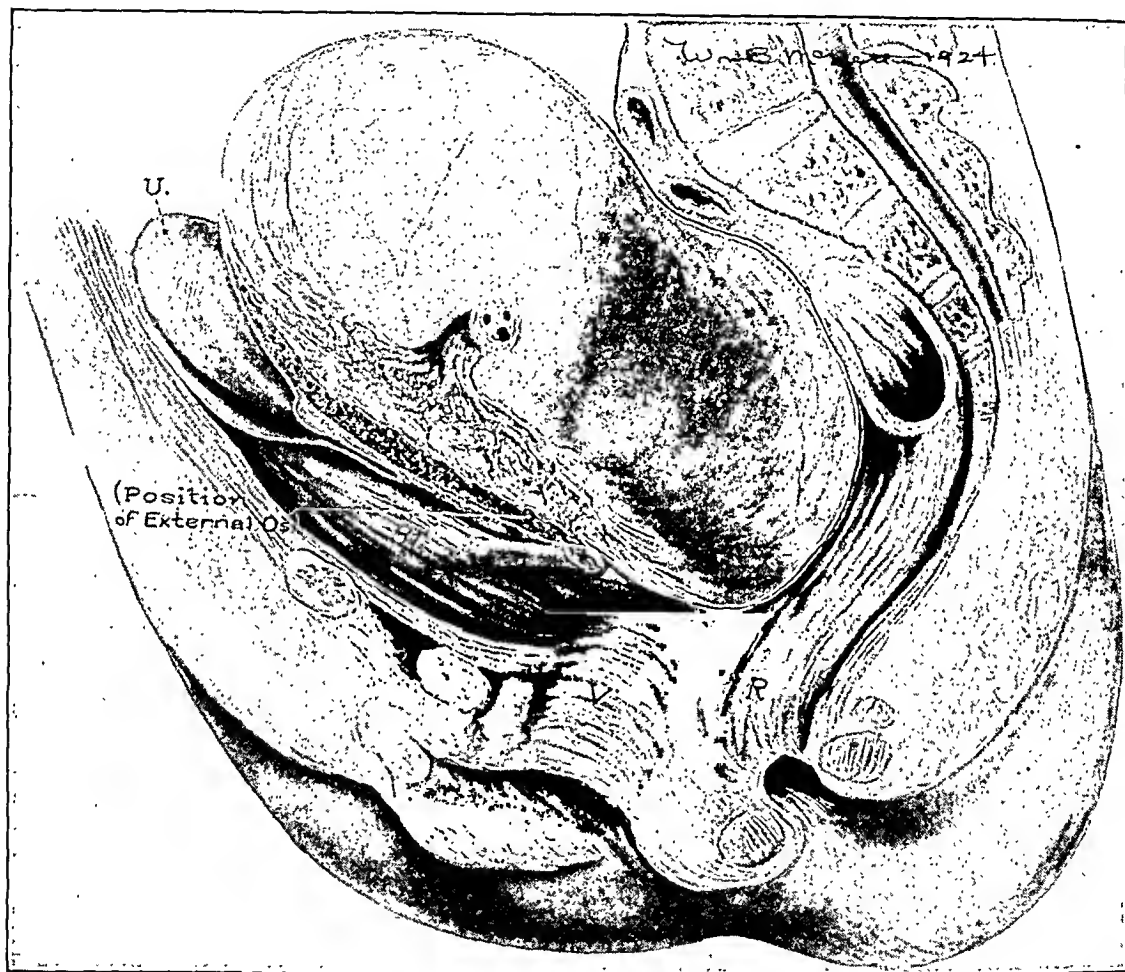


FIG. 589.—SAC EMPTIED OF FETUS, SHOWING ATTACHMENT OF PLACENTA TO STRUCTURES READILY REMOVED. (J. M. H. Rowland.)

of other complications is greatly lessened; it then becomes analogous to the removal of an adherent ovarian or dermoid cyst. A complete extirpation of the sac in this way has been possible in each of three cases of extra-uterine pregnancy operated upon in my clinic where the fetus had died during the seventh month, and in two where it had died during the ninth month. In all five there were no unusual difficulties to hinder the enucleation.

Rarely is the surgeon fortunate enough to see his case late in pregnancy when finding her in fairly good condition he feels justified in giving the child

a chance to live, or, as in a case in the hands of J. M. H. Rowland, the fetation may have reached full term with signs of imminent labor (*Surg., Gynec., & Obst.*, Jan. 1926), when the well-developed living child, weighing 8½ pounds, was delivered by the abdominal section from a thin tubal sac followed by the extraction of the entire placenta, attached to the posterior surfaces of the broad ligaments and the uterus, also removed, mother and child surviving the operation and living to-day after five years.

Interstitial Pregnancy.—Until 1917, Myer and Wynne state that about ninety-one instances of interstitial pregnancy are reported. Immediate operation is imperative as the risk is greater than in any other ectopic form. Ordinarily on opening the abdomen, it will be found that a resection of the uterine cornu in which the pregnancy is lodged is possible. Here it is wiser to resect the cornu and tube, paying particular attention to the suturing of the uterus and taking care not to leave a thin uterine wall—a source of danger in a future pregnancy. A supravaginal hysterectomy may be necessary, particularly if the pregnancy is far advanced.

An interesting interstitial pregnancy was studied at the Yale Woman's Clinic in a woman thirty-two years old, admitted January 9, 1926, who had had two full-term spontaneous deliveries and a spontaneous abortion in the last pregnancy in 1919. The last regular period was early in November. She menstruated again from December 1 to 10 but attached no importance to the prolonged flow.

On the day of admission, she was seized with a sharp pain in her right side and fainted. Examination at entrance revealed shock with no external bleeding. The uterus was about the size of a ten weeks' pregnancy with an irregularity at the right cornu, and clotted blood could be felt in the bulging culdesac. A diagnosis of ruptured ectopic pregnancy with a uterine myoma was made. At the operation, L. K. Musselman found a right interstitial pregnancy ruptured through the posterior uterine wall, the point of rupture being plugged with placental tissue protruding into the peritoneal cavity. The corpus luteum of pregnancy was situated in the left ovary. A supravaginal hysterectomy with a right salpingo-oöphorectomy was done, followed by a good recovery.

The pathological examination revealed a uterus measuring 7 centimeters in length, 12.5 by 5 centimeters in breadth. Extending laterally from its right side was a softened, rounded, fluctuating portion measuring 7.5 by 7.5 by 8 centimeters, with the tube coming off from the extreme end of this mass. Anterolaterally were numerous distended blood-vessels and in the vicinity of the cornu, tissues purplish-blue. The uterine wall was exceedingly thin and just posterior to the tube was an area 1 centimeter in diameter, slightly bulging, in the center of which through a small opening 0.8 centimeter in diameter soft gray tissuelike placenta was visible. A thin bluish membrane suggesting chorion also bulged through the perforation. Ovarian ligament was attached to the

lower posterior surface of the cystic area. On sectioning the specimen transversely, the uterine cavity 5.5 centimeters in length contained decidua. At the right uterine cornu a cavity 6 centimeters in diameter contained a male fetus 7 centimeters from crown to rump with placental attachment to the lateral anterior wall. The condition was obviously an interstitial ectopic pregnancy.¹

In one interstitial pregnancy after opening the abdomen, we were able to introduce a sound through the cervix and remove the products of conception

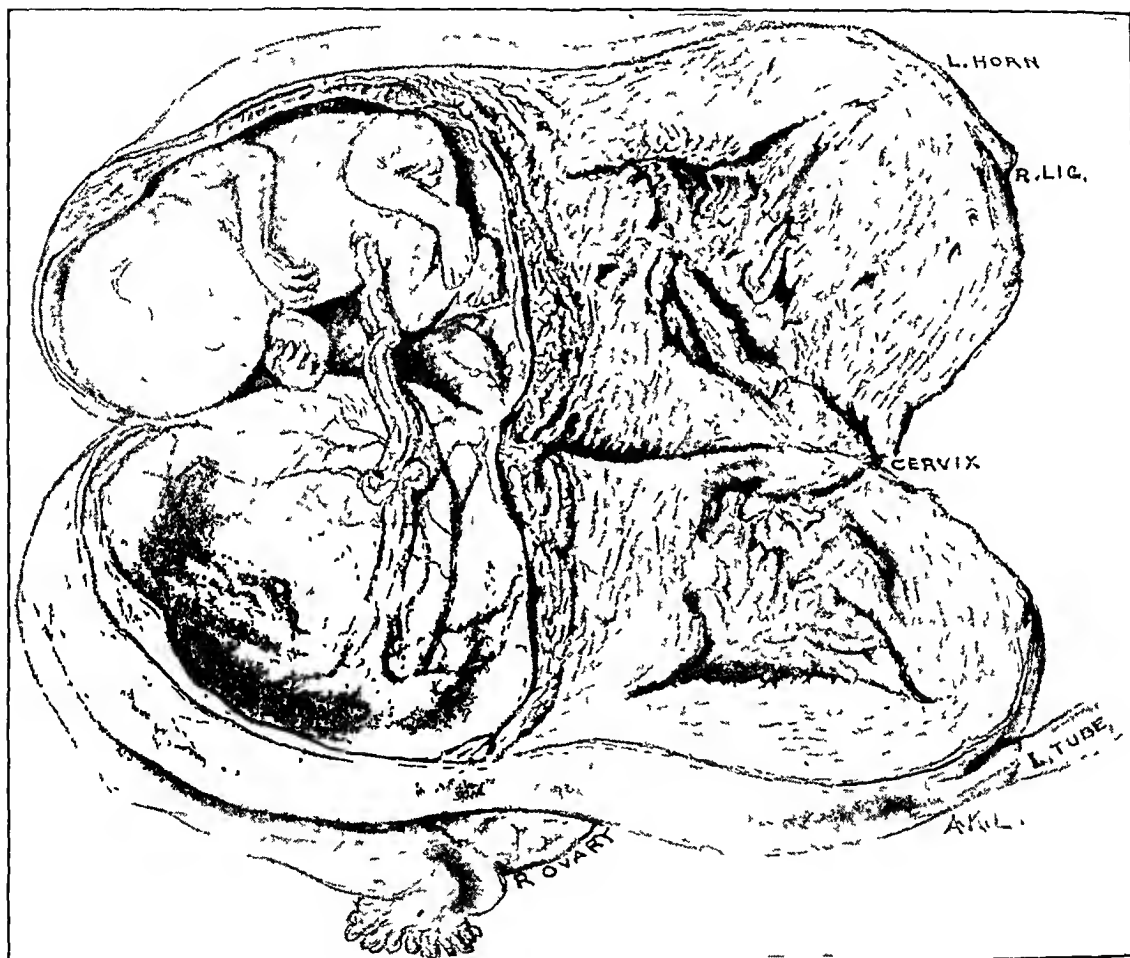


FIG. 590.—TUBO-INTERSTITIAL PREGNANCY.

Three months' interstitial pregnancy at right uterine cornu, showing fetus with placenta and membranes. (Yale Woman's Clinic.)

without excision. Schumann describes a cornual pregnancy treated successfully in this way by B. C. Hirst. Farrar reports a similar case. On the whole, however, this is not advisable as a method of treatment.

Mortality.—The mortality of extra-uterine pregnancy uninterfered with is 68.8 per cent, according to Schauta, reckoned on a basis of 241 cases. This does not include early cases in which a rupture takes place without severe

¹From Arthur Morse's pathological report.

symptoms and the patient complains only of colic and goes to bed for a short time, exhibiting no pallor, and the blood is soon absorbed (Veit.)

As in the case of acute appendicitis, the operative mortality of ectopic pregnancy in a given community depends more upon the average diagnostic ability of the general practitioners than upon the skill of the consulting surgeon who is eventually called in.

Cases seen and operated upon early, who are neither shocked nor infected, should yield a mortality no higher than other laparotomies *per se*. So long as women are referred in a tragic condition of collapse, many lives will continue to be lost.

Seventy-one successive ectopic pregnancies operated upon in the Johns Hopkins Hospital Gynecological Service between February, 1913, and September, 1922, were without a fatality. The one preceding this series died of general peritonitis; here a large amount of foul pus was found and the fatal outcome was inevitable in spite of free drainage.

In fifty successive cases at the Yale Woman's Clinic there was one post-operative death. One patient died immediately after admission before she could reach the operating room.

PREGNANCY IN A RUDIMENTARY UTERINE HORN

Closely allied to an extra-uterine gestation is a pregnancy in a rudimentary horn of the uterus, a reversionary malformation due to the failure of Müller's ducts to coalesce in their upper portion in early fetal life when the uterus bifurcates at some point above the vagina. Both horns may develop alike or form a large gibbous uterine body with normal tube and ovary, while the other is left entirely rudimentary and either connected with the cervix by a fine canal or completely shut off, maintaining open connection with its own tube and ovary which are normal. The muscular band connecting the rudimentary half to the cervix averages about 1 centimeter in breadth and from 3 to 7 centimeters in length.

When a canal communicates with the vagina, the pregnancy may take place in the rudimentary horn *per vias naturales*. On the other hand, if the band of union between the rudimentary horn and the uterus is atresic, a pregnancy here can then only occur by migration of an impregnated ovum from the normal side, or by a similar migration of the spermatozoön.

Pregnancy is found in the rudimentary horn of the uterus most frequently between the ages of twenty and thirty, and often in women who have previously borne children naturally from the better developed side.

The tendency of this aberrant form of pregnancy is to rupture at a somewhat more advanced stage than a tubal pregnancy; namely, from the fourth to the fifth month. Rupture is likely at the thinnest point near the origin of the tube, and a large amount of blood extravasated. The pregnancy has also been

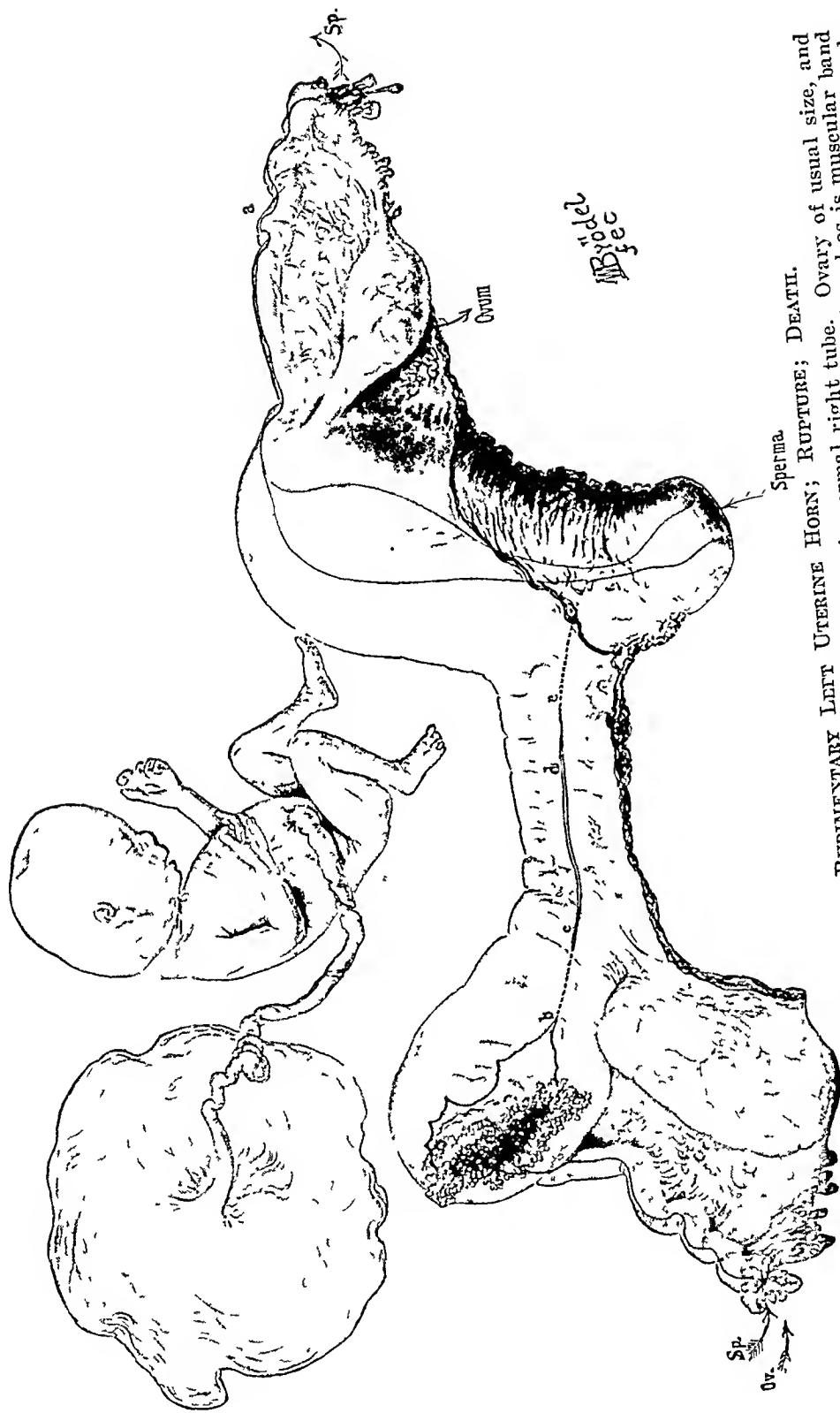


FIG. 591.—PREGNANCY IN RUDIMENTARY LEFT UTERINE HORN; RUPTURE; DEATH. Viewed from behind. To right a well-developed uterus. Attached to cornu is normal right tube. Ovary of usual size, and at its inner and lower portion corpus luteum of pregnancy. Springing from left side of uterus at internal os is muscular band which merges into rudimentary uterine horn, on posterior surface of which is point of rupture. Placental remains protrude through rent. Left tube passes off from outer side of rudimentary horn. Left ovary flattened. Red line on well-developed uterus indicates size of uterine cavity. Lane b, c, d, e indicates course of left Muller's duct, between c and d containing a lumen; dotted lines consist of solid muscular cord. Above the specimen are the placenta and fetus drawn in normal size. $\times 1$.

found advanced to full term, characterized by intermittent pains throughout. Then at or near term pains set in and a false labor continues for several days, productive only of a bloody vaginal discharge.

The enlarged developed half of the uterus contains a well-formed decidua, sooner or later cast off.

In an instance in which pregnancy terminated after several months without rupture, at the autopsy years later an abscess was found in a rudimentary horn containing fetal bones. In another, calcified fetal bones were found on the pelvic floor, with a well-defined scar in the rudimentary uterus.

Although the anatomical picture is such a clear one, an accurate diagnosis is difficult. If seen after rupture there will usually be no time to go into greater detail than to determine the existence of an intrapelvic hemorrhage due to an abnormal pregnancy. If seen at an early date before rupture, two signs will be of value in determining the character of the pregnancy: (1) The developed side deviates at an angle of from 40 to 60 degrees from the normal. (2) On rectal examination the pregnant horn is connected with the uterus by a broad band which is attached at the lower part of the uterine body.

The treatment is that of an extra-uterine pregnancy—the prompt removal of the rudimentary uterus with its ovum.

An interesting instance occurred in the practice of G. L. Wilkins of Baltimore. The patient, a German twenty-nine years old, had had one child; later she had had two attacks of severe left-sided pain called "ovaritis," after three months of amenorrhea, agonizing pelvic pain, rectal and vesical tenesmus, and marked abdominal tenderness, with no vaginal discharge. A tumor the size of an orange was felt on the left, behind the uterus. The pain suddenly ceased after two days. A period of calm ensued, followed by fainting, extreme pallor, and cold sweats, with a small, feeble pulse, and abdominal distention, Figure 591.

A sound was introduced into the uterus, which was 10 centimeters in depth and empty. Death occurred six hours after the onset of the collapse.

At autopsy the abdomen contained 4,000 c.c. of blood and a three to four months' fetus with its investing membranes, connected by its cord with a rudimentary left uterine horn, floating in the peritoneal cavity.

Microscopically, the right uterus showed typical decidua, and the right uterine tube contained remains of the placenta free in its lumen. The cells of the corpus luteum in the right ovary closely resembled normal decidual cells. The pedicle joining the two horns at the cervix contained a canal blind at both ends, 5 millimeters in diameter, lined with a single layer of cylindrical epithelium resting on a delicate stroma; external to this was a circular muscular coat covered by longitudinal muscular fibers.

The only explanation of the location of the pregnancy is a migration of the right ovarian ovum and spermatozoön across the left side via the abdominal cavity.

CHAPTER XXXVII

TUMORS OF THE OVARIES

GEORGE H. GARDNER AND HERBERT F. TRAUT

CLASSIFICATION

Simple Retention Cysts

New Growths

I. BENIGN EPITHELIAL TUMORS

Simple Serous Cystoma

Multilocular Ovarian Cystadenoma

Pseudomucinous Cystoma

Papillary Tumors

II. MALIGNANT EPITHELIAL TUMORS

Carcinoma

Papillary Adenocarcinoma

Papillary Cystadenosarcoma

Other Forms

Secondary

Krukenberg

Mixed

III. EMBRYOMATA

Dermoid Cyst

Teratoma

IV. CONNECTIVE-TISSUE TUMORS

Fibroma

Sarcoma

Parovarian Cysts

Hydatid of Morgagni

Inflammatory Cysts

CLINICAL COURSE

DIAGNOSIS

COMPLICATIONS

Rotation of Pedicle

Cystic Rupture

TREATMENT

Operation

ADHESIONS

LIGATING THE PEDICLE

INTRALIGAMENTARY CYSTS

COMPLICATED CASES

OPPOSITE OVARY

Radium and X-Ray

The ovary, although but a diminutive organ, is peculiarly rich in cellular elements of various kinds which may give rise to a variety of tumors. It is difficult also to dissociate mentally the wonderful function of the ovary as a reproductive organ from its marvelous activity as an atypical tissue producer, when once its activities have become perverted.

We find in the ovary, retention cysts, epitheliomata (using the word broadly to include adenomata and carcinomata), connective-tissue tumors, parovarian cysts, inflammatory cysts, and abscesses.

Classification.—A convenient classification follows:

Simple retention cysts

Inclusion

Graafian follicle: single (large); multiple

Corpus luteum

Endometrial

Multiple lutein; bilateral

New growths or neoplasms

Benign epithelial

Simple serous

Cystadenomatous (multilocular ovarian)

Pseudomucinous

Papillary

Malignant epithelial

Adenocarcinoma

Papillary carcinoma

Other forms, including secondary carcinoma, Krukenberg, mixed, luteoma, hypernephroma, etc.

Embryomata

Dermoid, including dermal rests

Teratomatous

Connective-tissue tumors

Fibroma

Sarcoma

Parovarian cysts

Hydatid of Morgagni

Inflammatory cysts

Tubo-ovarian inflammatory

Tubo-ovarian abscess

Pyogenic abscess

Tuberculous abscess

The relative frequency of the different kinds of ovarian tumors varies greatly. Five hundred and fifty-six large tumors of the ovary, differentiated macroscopically in the operating room, were grouped as follows:

CYSTIC TUMORS

Cystadenomata, unilocular and multilocular.....	247
Papillary tumors	54
Cystadenomata with cancerous degeneration.....	21
Dermoid cysts	87
Multiple lutein cysts associated with chorio-epithelioma..	1
	<hr/>
	410

SOLID TUMORS

Carcinoma	90
Sarcoma	19
Fibroma	24
Papilloma (without cysts).....	13
	<hr/>
	146

A thorough sifting of this material in the pathological laboratory has demonstrated the need of a careful microscopic examination in every case; in this way, dermoid cysts were found where none were suspected on account of their diminutive size, and inflammatory masses were sometimes found due to dermoids which had discharged their contents and only revealed their true character when the cell elements were studied.

The group of papillary cysts was also enlarged by a microscopic examination at the expense of the multilocular and unilocular simple cysts and cystadenomata.

The group of unilocular cysts of the ovary, when more carefully studied, was diminished by the discovery of small cysts in the walls; these tumors were, therefore, in most instances reclassified as multilocular. Such a reclassification was also necessitated by the frequent finding of trabeculæ on the inner cyst wall—the remains of partitions between originally separate cysts later fused by pressure and atrophy of the septa or by spontaneous rupture.

In marked contrast, therefore, to the group of tumors classified by their macroscopic appearances, another group of 555 large ovarian tumors is presented, every one of which was examined microscopically and found distributed as follows:

Cystadenoma	243
Cystadenoma with malignant degeneration.....	5
Papillary cystadenoma	86
Carcinoma	81
Fibroma	33
Sarcoma	15
Dermoid	90
Tumors from wolffian duct.....	2
	<hr/>
	555

These contrasted lists demonstrate the importance of a searching microscopic study of every case in order to place diagnosis, treatment, and prognosis on a higher scientific footing.

An important clinical classification is into benign, malignant, and semimalignant tumors. It must be borne in mind that these terms are clinical expressions and therefore vague. A benign tumor does not tend to recur when extirpated, neither does it tend to implant itself elsewhere or invade tissues. A malignant tumor tends to destroy life by invasion of the surrounding and subjacent tissues, as well as to distribute its elements by metastases to other parts of the body. A semimalignant tumor may extend to the adjacent parts by implantation and then may or may not continue to grow after the removal of the parent tumor.

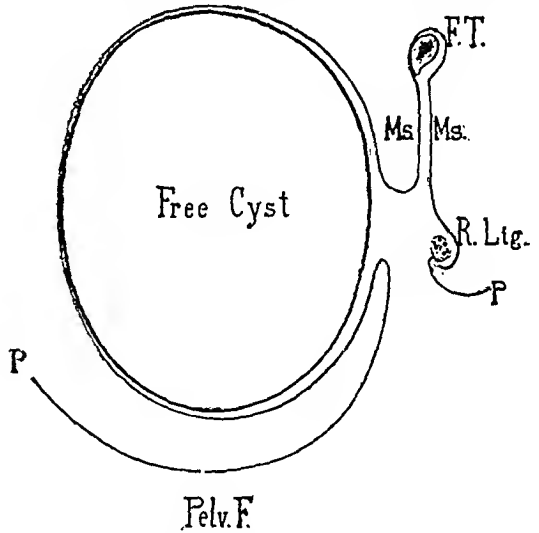


FIG. 592.—DIAGRAM SHOWING RELATIONS OF AN OVARIAN CYST TO PERITONEUM OF PELVIC FLOOR AND BROAD LIGAMENT.

F T, uterine tube, with intact mesosalpinx (*Ms.*). Red line (*P, P*) is peritoneum extending to hilum of ovary, but not covering it.

In general, the multilocular cystadenomata, the dermoids, the fibroids, and the parovarian cysts are classified as benign; the papillary tumors as semimalignant; and the carcinomata and sarcomata as malignant.

The essential weakness of such a clinical classification is shown histologically by recognizing that many of the cystadenomata contain papillary elements and that many of the apparent papillomata are in reality carcinomata and sometimes even show sarcomatous changes.

From a practical standpoint, all ovarian tumors must be considered malignant until removed and proved otherwise.

SIMPLE RETENTION CYSTS

Simple retention cysts are not considered here. Some have been placed among those affections which are best treated by conservatism; multiple lutein cysts are discussed in connection with hydatidiform mole and the endometrial cysts (Chapter XXXIX).

NEW GROWTHS

I. Benign Epithelial Tumors.—*Simple serous cystoma* is a type of cyst not generally accepted as an entity, consequently it is accorded but brief mention. They are small, rarely larger than an infant's head, unilocular, contain clear

fluid, have thick opaque walls, and, as a rule, are freely movable. There is nothing significant either in the symptomatology or palpatory findings to differentiate them from other cysts.

Microscopically, the walls are fibrous with attenuated ovarian stroma, covered by germinal epithelium and lined by cuboid epithelium in a single layer.

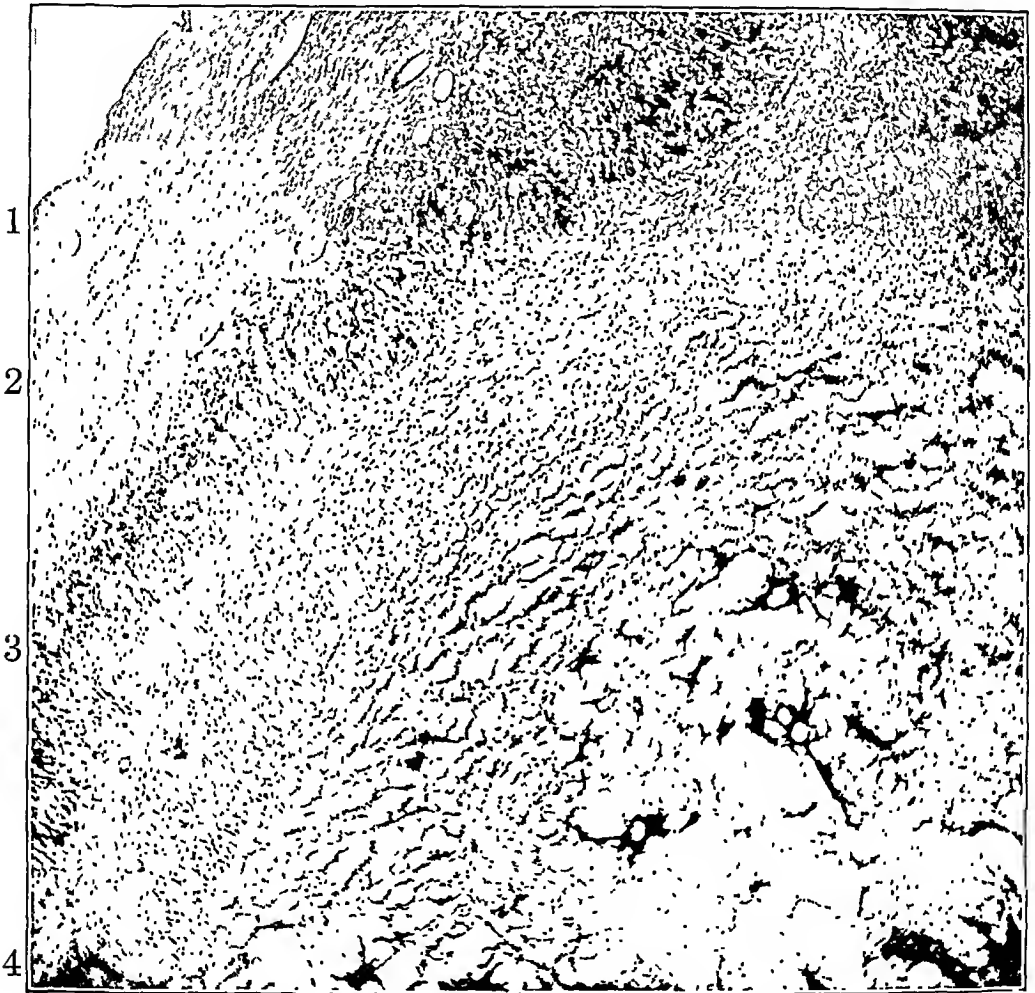


FIG. 593.—CORPUS LUTEUM CYST.

1. Germinal epithelium of ovary.
2. Compressed ovarian stroma.
3. Layer of lutein cells.
4. Cyst contents with beginning organization peripherally.

They have the gross appearance of small multilocular cystadenomata but are unilocular with no adenomatous tissue; papillæ are not present. Many classify them as large retention cysts or as small multilocular cystadenomata, but they seem rather to occupy a peculiar position midway between retention cysts and the classical outspoken cystadenomata. We, therefore, accept the simple serous cystoma as a definite pathological entity although its importance outside the laboratory is slight.

Multilocular ovarian cystadenoma, Figure 595, is the classical tumor of the gynecologist, which, in combination with Sims's plastic work, created his specialty. It was recognized and operated upon for many years before any clear distinctions of the microscopical or clinical characters of other ovarian tumors obtained recognition.

It owes its origin to a multiplication of the glandular ovarian elements, the glands becoming distended with secretion and the fluid accumulating with

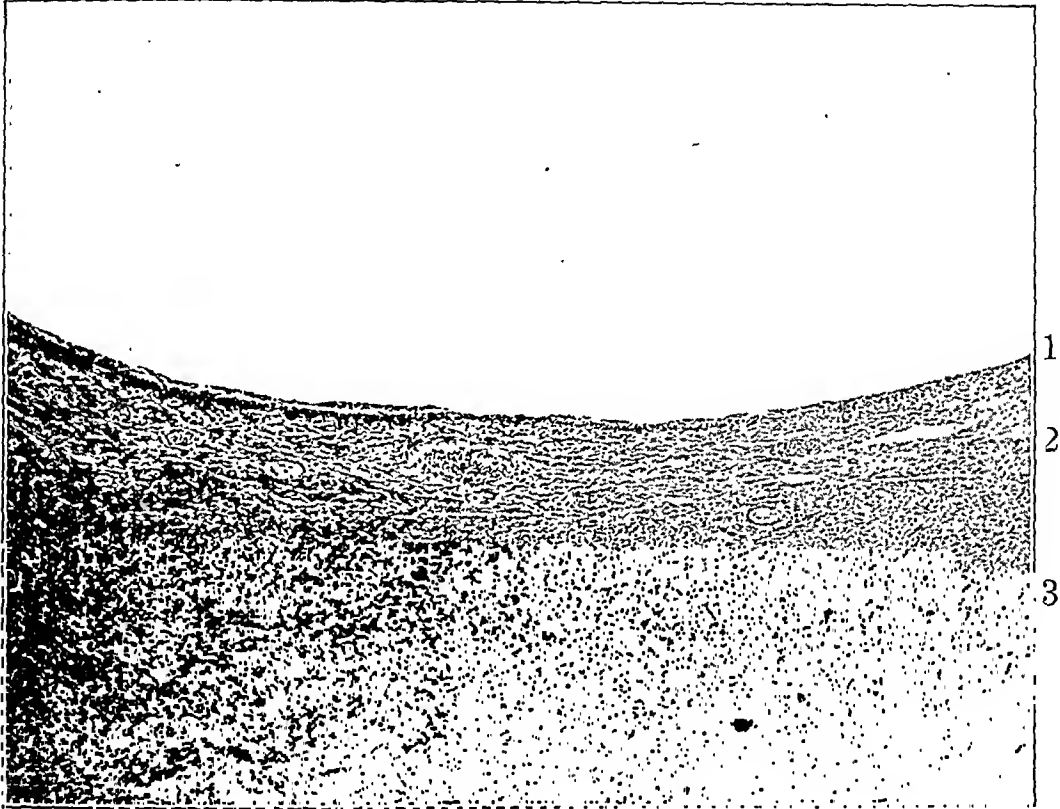


FIG. 594.—ATRETIC OVARIAN FOLLICLE CYST.

1. Thin lining layer of granulosa cells.
 2. Theca interna and externa.
 3. Ovarian stroma with primordial follicles.
- X 50.

varying degrees of rapidity to form cysts of all sizes. The tumors are usually unilateral, occurring somewhat oftener on the right side than on the left. Six per cent of our cases have been bilateral.

The size may vary from a mass of several inches up to one of large proportions, weighing a hundred pounds or more; Brobdingnagian tumors, however, are rarely met outside of primitive communities as the instructed patient now applies for treatment while the discomforts are still moderate.

The entire tumor usually lies free in the abdominal cavity, appearing as a round or oval mass with a smooth and glistening surface and irregular outline with numerous bosses, large and small, representing individual cysts, the walls

GYNECOLOGY

of which are pearly white or slightly bluish or pinkish; beneath the peritoneum, numerous branching blood-vessels radiate from the main trunks in the pedicle. On section, the appearance is usually that of one or more large cysts surrounded by numerous small ones, many lying in the walls of the larger. As the cysts enlarge, their walls come in contact, and pressure thins the partitions and unites

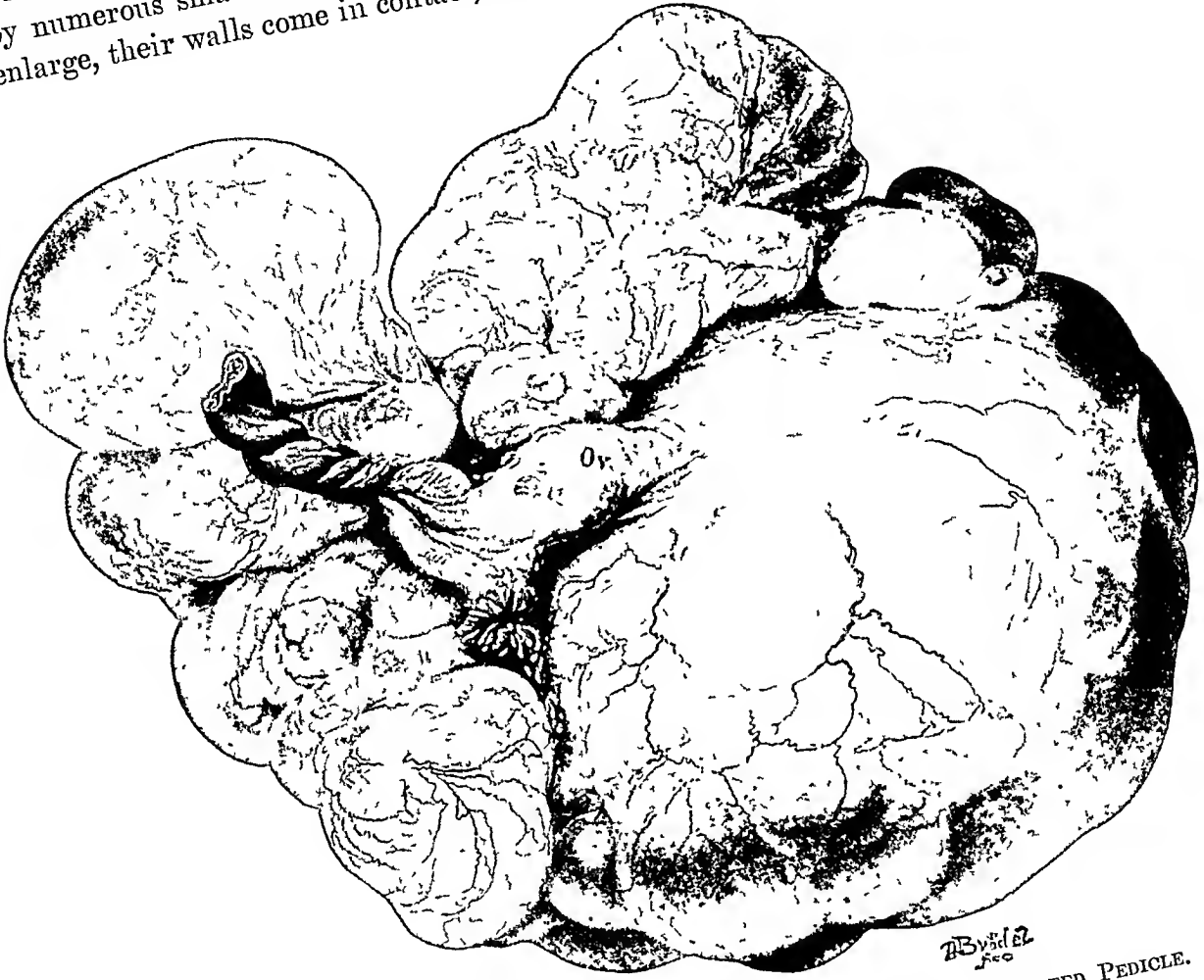


FIG. 595.—TYPICAL POLYCYSTIC OVARIAN TUMOR, WITH LONG TWISTED PEDICLE. Larger portion of ovary (Ov) intact; tumor occupies outer extremity. Abdominal end of uterine tube below ovary. $\times \frac{1}{2}$.

adjoining cysts, Figure 596. In a recent rupture, the septum appears as a perforated diaphragm, later it forms a falciform edge on the cyst wall, and finally forms simply a ridge or band. More rarely, the greater part of the tumor is a mass of small cysts and appears honeycombed on section.

The cyst walls are from 1 to 5 or more millimeters thick, composed of a dense tissue, with here and there areas of calcification and occasionally a dilated graafian follicle or a corpus luteum in a thickened portion or irregular, brown, slightly raised patches representing old hemorrhages.

The surface of the tumor either has no epithelial covering or is covered by a

layer of flat cells. The walls are of connective tissue in layers parallel to the outer surface and near the inner surface, rich in cell elements. The blood supply varies from abundant to scanty. Hemorrhage into the cyst wall is

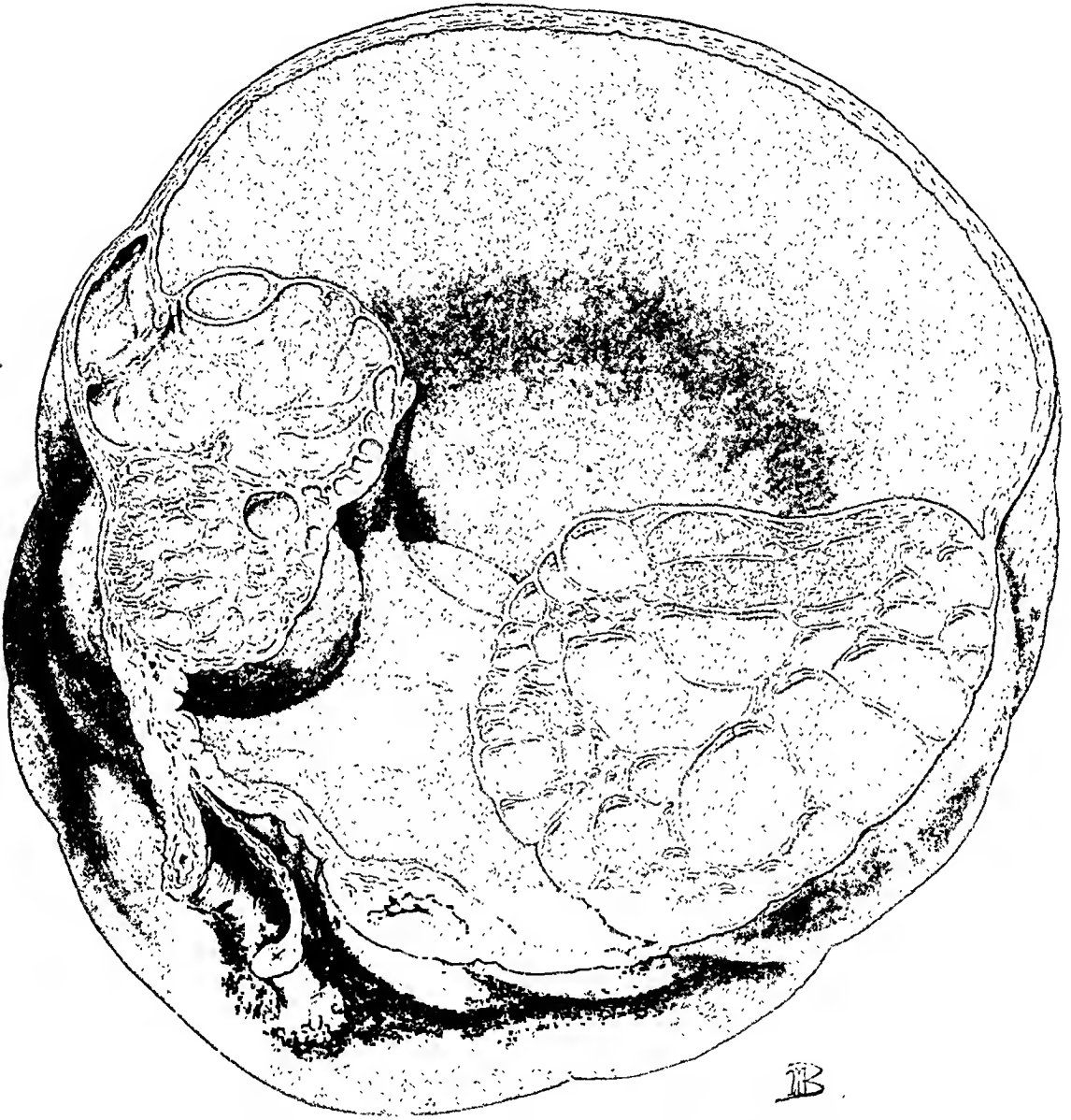


FIG. 596.—MULTILOCULAR OVARIAN CYST WITH A GROUP OF SMALLER CYSTS PROJECTING INTO CAVITY OF LARGE ONE, WHICH THUS EXTERNALLY LOOKS LIKE A MONOCYSTIC TUMOR.

Utero-ovarian ligament and uterine tube cut across below. $\times \frac{3}{4}$.

common. The walls are often edematous or necrotic in places. In the vicinity of the pedicle, nonstriped muscle-fibers are found.

The partitions between the smaller cysts are of connective tissue, richer in cell elements, in which are numerous convoluted glands, rudimentary cysts.

The inner surfaces of large and small cysts are lined by a single layer of low columnar epithelium, with nuclei oval or almost flat, usually on the base-

ment-membrane. Nuclear figures are occasionally seen. In some larger cysts, but particularly in the smaller ones, the walls appear scalloped or convoluted, resembling acinous glands, whence the name cystadenoma.

Calcified areas are common, either as small scales or granules in the parietal fibrous tissues.

This form is not infrequently associated with a dermoid of the opposite side or with a parovarian cyst, Figure 597.



FIG. 597.—POLYCYSTIC OVARIAN TUMOR AND PAROVARIAN CYST ON SAME SIDE.

Between cysts is a firm nodule about size of a bean. $\times 1$.

The fluid is thinner in the larger than in the smaller cysts and is grayish-yellow, gray, reddish-brown, or dark brown, the color depending largely on the hemorrhages. The blood is usually distributed and clots are rarely found.

The specific gravity varies from 1.010 to 1.030. It carries much albumin and desquamated fatty epithelium and large cells filled with yellowish pigment. Some of the smaller cysts contain a yellowish-white, semitransparent viscid fluid; others, a yellowish, transparent, jellylike material, slightly tenacious. The fluid from the smaller cysts, as from the larger, contains desquamated epithelium, fat droplets, and detritus. Occasionally, a few scattered, needle-shaped crystals are found.

The fluid has three sources: The secretion from the epithelial cells, transudation of serum from the blood-vessels, and the destruction of cells.

The tumor usually develops free in the abdominal cavity with the ovarian ligament, the fallopian tube, or the broad ligament for a pedicle; a big tumor exerting much traction pulls the pedicle out for several inches. The parovarium is generally intact. Occasionally the development is between the layers of the broad ligament, forming an intraligamentary cyst and pushing toward the uterus, toward the bladder, backward into Douglas's culdesac, and out between the layers of the peritoneum under cecum and rectum.

Adhesions between the abdominal viscera and some portion of the cyst are fairly common; among thirty-six multilocular cysts operated upon, twenty-two presented no adhesions at all, while fourteen were adherent in varying degrees from a few light omental attachments all the way to extensive parietal, intestinal, and pelvic attachments. The omentum is more apt to adhere to the cyst wall than is any other abdominal organ, either in long ribbonlike attachments or engaging the whole free omental border. In the days of our ancestors, when tapping was *de règle*, adhesions were almost invariably between the abdominal parietes and the cyst wall, and bad ones at that. The wall of the larger cyst sometimes ruptures and pours its contents into the abdominal cavity. Some smaller cysts then develop rapidly and may plug the rent in the larger cyst, eventually obliterating it.

Out of thirty-five, the growth was rapid in twenty-three, gradual in seven, and slow in five; of the latter, two had ruptured, decreased in size, and reappeared. The longest duration noted was ten years; others had existed for five, three, one-and-a-half, and one year, and for six months, two months, and five weeks—this, of course, means nothing more than that the patient had discovered a large tumor at the date specified.

The cause is unknown; age is a predisposing factor—they are rarely found in girlhood or in old age. Our youngest patient was fifteen and the oldest seventy-three and seventy-five. The average age was 42.5 years; the time of greatest predisposition approximates the cessation of reproduction.

The tumors are usually discovered only when large enough to push forward the lower abdominal walls which are splinted on the tense sac; the rise from the pubis up to the point of greatest prominence is not apt to be as abrupt as in a large spherical myoma which also presents a steeper declivity above, where the abdominal walls rise and fall with the breathing. A big cyst fills out the flanks without the sagging seen in an ascites. The general more or less markedly flattened cylindrical or oblate ellipsoid enlargement of the abdomen, common to ascites, is wanting. When the tumor is massive, the abdominal wall yields below the umbilicus, letting the mass fall down over the thighs, even to the knees. A patient who had had an ovarian tumor of more than a hundred pounds had not seen feet nor knees for months. The average girth of six large tumors was 108 centimeters, the largest, 123 centimeters. A cir-

cumference of more than 100 centimeters does not fairly indicate the size of the tumor, as the further distention is likely to be downward.

Pressure symptoms supervene sooner or later with the growing tumor; it is remarkable, however, that some huge tumors are carried without any other inconvenience than weight. Again, pressure on bladder and rectum interferes with function, and one or both ureters may become hydro-ureteric with hydronephrosis; albumin, casts, and dysuria were noted in 50 per cent of the cases at the Johns Hopkins Hospital, often to disappear after operation. There is often marked interference in digestion, with flatulence, nausea, and vomiting. Respiratory and circulatory functions are embarrassed when the viscera are crowded up against the diaphragm. Other evidences of pressure are edema of the legs, lower abdomen, and vulva, and enlargement of the superficial abdominal veins. The red striæ characteristic of pregnancy also form. Menstruation is variable, not affected in 50 per cent; again, it is irregular, scanty, or absent, or excessive.

The general health suffers greatly; in an advanced stage, emaciation is marked. Occasionally the health is excellent. The characteristic expression of a woman with a large ovarian tumor has been docketed the *facies ovariana* (Spencer Wells, *Ovarian Tumors*).

Pain is not characteristic. The discomfort produced by the pressure is usually a dull, heavy, dragging sensation, noted in nineteen of the group; three had a sharp cutting pain, but the rest had no noteworthy complaint. Attacks of pain at intervals, sometimes severe and associated with a slight rise of temperature and a quickened pulse, point to localized peritonitis. Such attacks are usually over in a few days or a week, but they may leave behind them vascular adhesions between the cyst and adjacent peritoneal surface. This was common in days of yore.

Pseudomucinous Cystoma.—All the above applies as well to the pseudomucinous cyst, except two vital factors affecting the lining cells and the cyst contents. The origin, symptomatology, method of growth, and general characteristics are identical with the classical multilocular serous cystadenoma.

The multilocular condition is not so outspoken, as there is usually but one large compartment, and it may take a careful search to discover additional loculi.

Pseudomucinous cysts do not often reach the girth of the ponderous serous cysts; a man's head is an average size, and the weight is from 3 to 5 pounds.

The external appearance is like the serous cysts. The walls, usually very thin, are covered either with a greatly thinned out germinal epithelium or by no cells at all. They are composed of connective tissue arranged in stratified layers, poor in blood supply. The cysts are lined by a single layer of high cylindrical epithelium, with small round basal nuclei, with vacuoles in the mid or upper portion. The "goblet-cells" present the appearance of large bowel epithelium.

The second outstanding difference is a thick, tenacious, viscid, ropy fluid content—"pseudomucin," the most characteristic constituent.

In the early days when diagnosis was uncertain and operation dangerous, great importance was attached to the microscopic and chemical examination of the aspirated cyst fluid, when the discovery of an "ovarian cell," the "compound granular cell," and paralbumin and metalbumin were held pathognomonic for



FIG. 598.—WALL OF MULTILOCULAR OVARIAN CYST SHOWING SECRETING GLANDULAR SPACES AND FORMATION OF PSEUDOMUCIN.

In large space on right, lining epithelial cells seen in various stages, from those markedly granular with no pseudomucin to those with lighter cell contents and those with a goblet-cell full of pseudomucin, even bursting into cyst. $\times 170$.

ovarian cyst. Drysdale, Atlee's son-in-law, spent years in elaborating this method. But the "ovarian cell" has long since gone into the gynecological *Rumpelkammer*, while paralbumin and metalbumin still "carry on" with an identity altered by O. Hammarstein (*Ztschr. f. phys. Chemie*, 1882), who has excluded them from the albumin group, the former not being a chemically pure body and the latter being closely allied to mucin and hence called "pseudomucin," chemical examination of which shows that upon boiling with acids it separates a carbohydrate and that it differs from mucin in its acetic acid reaction. Pfannenstiel, studying the relation of pseudomucin to ovarian cysts

(*Arch. f. Gynæk.*, 1890, 38), calls it a "glycoproteid" because it splits up into a protein and a sugar.

Pseudomucin is abundant in the tough, sticky, mucilaginous substance capable of being drawn out in long threads; being soluble in water, its presence in small quantities can only be recognized chemically.

Pfannenstiel has also shown that pseudomucin does not result from a colloid cell degeneration as supposed, but is a real secretion of the epithelial cells, continuing indefinitely without cell destruction.

The various stages of the cells in the formation and excretion of pseudomucin are beautifully seen in a single cyst. The original epithelial lining of the cyst wall is represented by the short cylinders with a nucleus at the base and a feebly staining protoplasm; then we find long cells with a basal nucleus and a still more feebly staining cell-body, the first step in the evolution of pseudomucin which at this stage is evenly distributed throughout the cell-body and gives it already a somewhat glassy appearance. The next step is the separation of the pseudomucin from the protoplasm, with the pseudomucin lying in the periphery, while the protoplasm is crowded down to the base of the cell, the proportion varying with the amount of pseudomucin excreted; some cells appear entirely filled with pseudomucin. The various stages are illustrated in Figure 598.

Pseudomucin is not found in normal ovaries, in dropsical graafian follicles, nor in parovarian cysts; it is found in some papillary cysts, but it is the constant characteristic element of the pseudomucinous cystoma and only occurs in ascitic fluids in the presence of a pseudomucinous tumor.

Following the rupture, tear, or perforation of a pseudomucinous cyst and the escape of its viscid contents into the abdominal cavity, an interesting yet weird type of chronic peritonitis supervenes.

Pseudomyxoma peritonei is a diffuse invasion of the peritoneum by the mucinous and cellular elements of a ruptured pseudomucinous ovarian cyst, or it occasionally arises from the rupture of a so-called mucocele of the vermiform appendix. It is noteworthy that both of these rare conditions not infrequently are found in the same patient. Whenever one or the other ruptures or spills its contents, pseudomyxoma peritonei follows, although careful washing out of the soluble glairy fluid at the operating table may help to prevent it.

The pseudomucinous material is absorbed into the peritoneal lymphatics until they distend, become engorged, and rupture. Round-cell infiltration and growth of granulation tissue progress, while the goblet-cells continue their secretory activity and a widespread massive jellylike peritonitis results. Adhesions form, viscera become encased, fistulous tracts may form, and paresis of the intestines is a common and fatal issue. However, although these women present the clinical picture of widespread peritoneal carcinosis with ascites, the process is but semimalignant. With a peritoneum once diffusely involved, it is hard to eradicate the growth and the patients gravitate downhill, so that

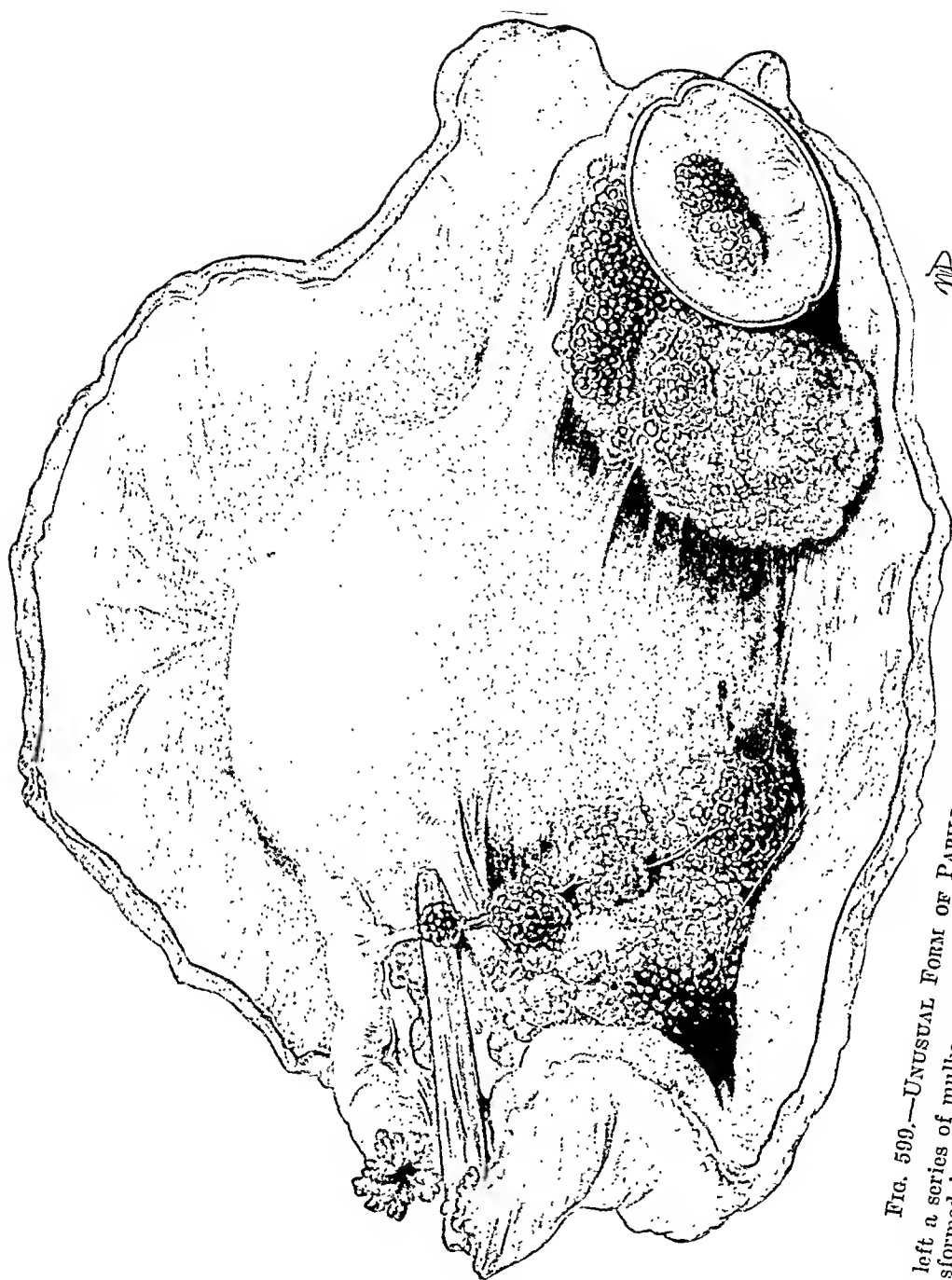


FIG. 599.—UNUSUAL FORM OF PAPILLOMATA OF BOTH OVARIES, SEEN *in situ* FROM BEHIND.
 On left a series of mulberry masses is hanging from a delicate pedicle attached to uterine tube; on right ovary
 is transformed into a mulberry mass, and inside a cyst two masses are seen sprouting. $\times 1$.

pseudomyxoma peritonei becomes clinically malignant. Some patients, however, live for years.

A similar picture may be produced by the diffuse peritoneal involvement of a colloid carcinoma which may be quite difficult to differentiate.

Fränkel first noted the coincidence of mucocele of the appendix and pseudomyxoma in a man; since, many others have been recorded.

Papillary Tumors.—These tumors constitute a well-defined group peculiar clinically and microscopically and characterized by a proliferation of the germinal epithelium, either on the surface of the ovary or in the graafian follicles or both.

It was first classified by Waldeyer as a variety of cystadenomata (*Arch. f. Gynæk.*, 1870, 1), explaining the difference in the clinical appearances of the two classes by assuming that the stimulus of growth in the cystoma fell upon the epithelial elements which therefore preponderated, while in a papilloma the vascular connective-tissue stroma proliferated and so pushing out from its bed, covered by epithelium, formed the papillary trees.

Olshausen, however, in 1877, drew the sharp line of differentiation between the two and separated them as totally distinct (*Die Krankheiten der Ovarien*, pp. 50-60). Since then, careful clinical and histological studies, especially by J. W. Williams (*Johns Hopkins Hosp. Rep.*, 1892, 3) and J. Pfannenstiel (*Arch. f. Gynæk.*, 1895), have served to establish Olshausen's dicta and have subdivided the genus papilloma into several well-defined species under the following heads: cystoma parovarii papillare; hydrops folliculi graafiana papillaris; adenoma papillare pseudomucinosum; adenoma papillare simplex; adenocarcinoma papillare; adenosarcoma papillare.

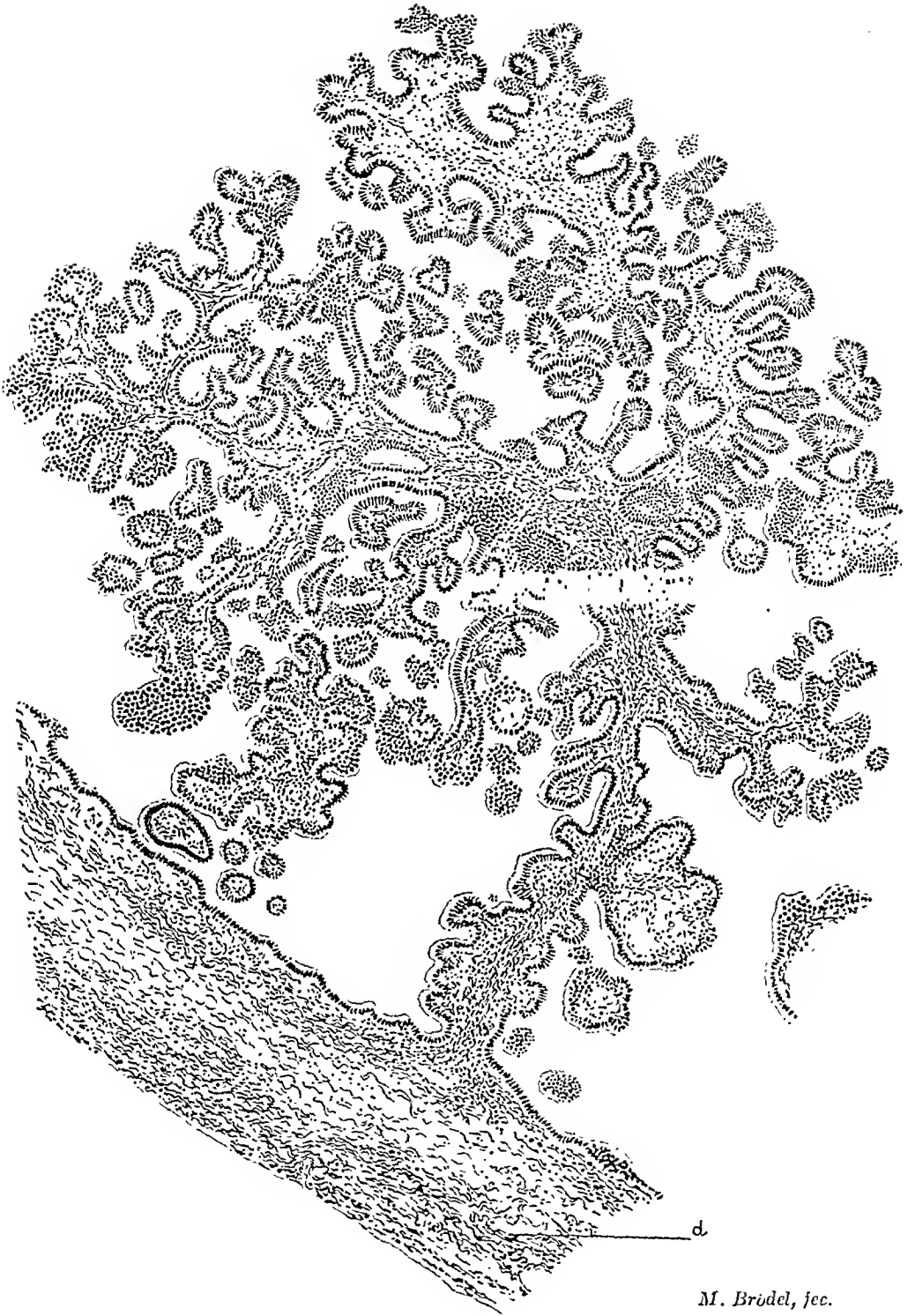
Out of 555 ovarian tumors of all kinds operated upon and examined in the Johns Hopkins Clinic, seventy-four were papillomata grouped as follows:

Multilocular adenopapilocystoma (one mixed with sarcoma)	54
Solid papillomata	13
Solid papillo-adenocarcinoma	5
Cystic papillo-adenocarcinoma	2

Of these, fifty-seven were unilateral and seventeen were bilateral; in one an ovary contained a cystic papilloma, while its fellow presented solid papillary masses on the surface, suggesting a close relationship.

Before studying these various papillomata, it will be well to look at them from the broader clinical standpoint of the operator, who groups the species under the generic papilloma.

While the ovarian cystoma is recognized as benign, prevailing opinion classifies papillomata as either malignant or semimalignant (under the impression that they are allied to the carcinomata, into which they do actually pass by metaplasia). It must be noted that malignancy is only a clinical term, while carcinoma is a purely anatomical expression with strict scientific significance.



M. Brödel, fec.

PLATE VIII.—SECTION OF SMALL NOBULE FROM INNER SURFACE OF TUMOR (FIG. 600).

Cyst wall (*d*) made up of wavy fibrous tissue poor in blood-vessels and lined on its inner surface by single layer of cylindrical epithelium. Papillary tree shown springing from cyst wall also has connective-tissue framework covered by single layer of cylindrical epithelium. in places cut slantingly. Blood-vessels few. Drawing exact reproduction of specimen. cell for cell. $\times 70$.

A papilloma has never been shown to have changed into a carcinoma, although from the standpoint of the clinician the frequent association of the two in one and the same tumor justifiably gives rise to the suspicion. Malignancy in the papilloma really refers to a group of symptoms with nothing in common with the invasive destructive tendencies of carcinoma but connoting a liability to provoke an extensive ascites and to the distribution and implantation of numerous new foci of the parent growth over the peritoneum. Such a choking of the peritoneum produces at last symptoms of pressure and obstruction and interference with nutrition—a syndrome closely simulating cancer cachexia. Metastases to glands and distant parts of the body occur rarely. There are many well-observed instances of papillomatous ovaries removed, leaving behind papillomatous masses implanted upon the peritoneum, where the patients have recovered and retained perfect health over a long series of years without any apparent increase. Lomer (*Centralbl.*

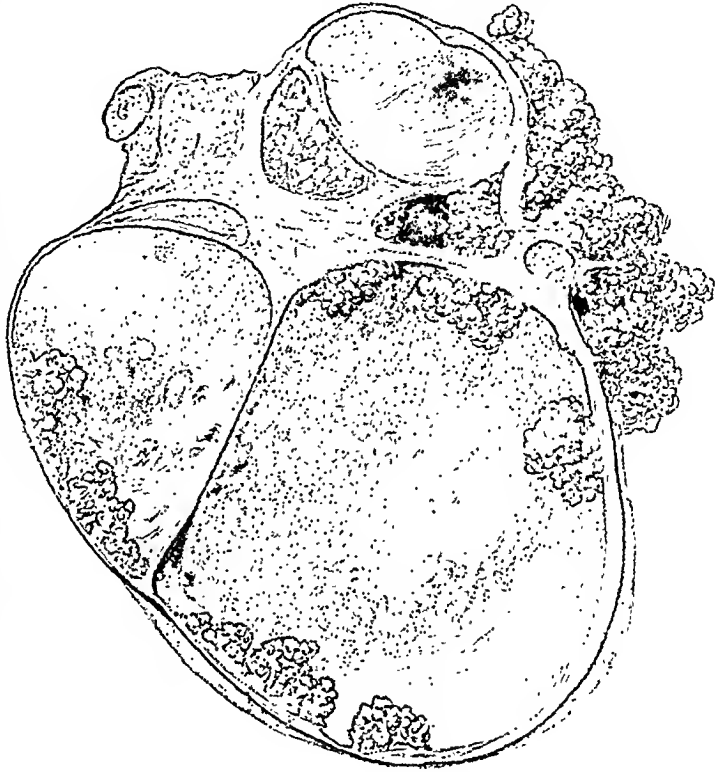


FIG. 600.—CYSTOPAPILLOMA OF OVARY, WITH PAPILLOMATOUS MASSES WITHIN CYSTS AS WELL AS ON SURFACE.

Both ovaries involved. $\times 1$.

f. Gynäk., 1889, 52) records two papillomatous tumors the size of the double fists, which were removed, leaving warty excrescences scattered over the intestines and the parietal peritoneum; four and a half years later, no trace of the trouble could be found.

In one of our Johns Hopkins Hospital groups, papillary masses were left in the pelvis and the patient was well fifteen years later and had gained 49 pounds. Plate VIII and Figure 600 are from this case.

The slow growth is illustrated by a patient with papillomatous masses choking the pelvis and covering intestines and abdominal walls, so locked in the pelvis and adherent that extirpation was impossible; the fluid was evacuated and the abdomen closed, removing a piece for examination. She returned in two years so improved in her general condition, and with the tumors so decidedly movable when examined bimanually, that the abdomen was reopened with the hope of extirpating the mass, only to find conditions about as at first.

She died finally some three years from her first visit with advanced disease which had been imperceptibly progressing.

Pfannenstiel (*Arch. f. Gynæk.*, 48) collected sixty papillomata in four hundred ovariectomies—about 15 per cent; twenty-nine of these were bilateral and twenty-six unilateral, and two uncertain. In ten out of eighty-nine, the disease was superficial to the ovary; in four out of sixty cases, there was a superficial papilloma on one side and on the other a papillary cystoma, proving that there is no fundamental distinction between papilloma in and papilloma on the ovary.

In about a third of the cystic papillomata, masses are found on the outer surface. A fact tending to do away with any other than a clinical distinction between solid masses on the surface of the ovary and those originating within cysts, is the discovery of graafian follicles choked with papillomata which sprout through the follicular wall and vegetate over the surface of the ovary.

The average age in thirty-three was 42.5 years, the oldest being fifty-six and the youngest twenty-six.

About a third of the papillomatous cystomata are unilocular, while they usually show traces of atrophied partitions upon their walls, making the one cyst but the fusion of many.

They may vary from microscopic bodies up to tumors as big as an adult's head; large tumors are rare.

The greatest abundance of papillomatous masses is found in the smaller tumors; in the larger they are apt to be thinly distributed over the walls and more abundant at the hilum with its larger blood supply. Little chalky bodies are often found on the surface or in the tumor walls like the psammomata of Virchow. Williams points out that these may be found in widely different conditions.

Twice I followed a patient from the time the tumors were small and barely palpable on the pelvic floor behind the broad ligaments.

One had a mass behind the left broad ligament 4 centimeters in diameter, spherical, clearly cystic, and adherent; she returned in two years in fair health, with a pelvis choked with bilateral tumors extending up into the abdomen. At the operation, it was utterly impossible to remove them and she died of exhaustion in five months.

Another patient was examined for severe pelvic pain and an unaccountable weakness, and small adherent masses behind both broad ligaments with no demonstrable ascites were discovered; in three months the abdomen was enormously distended with fluid. When this was evacuated, the adherent papillary ovarian tumors were removed, leaving numerous small implantations peppering bladder and pelvic peritoneum; all went well until the twelfth day, when she suddenly died of pulmonary embolus.

The patient was forty-one years old and complained of a progressive distention and *pari passu* an abdominal enlargement. Four months before,



A



B

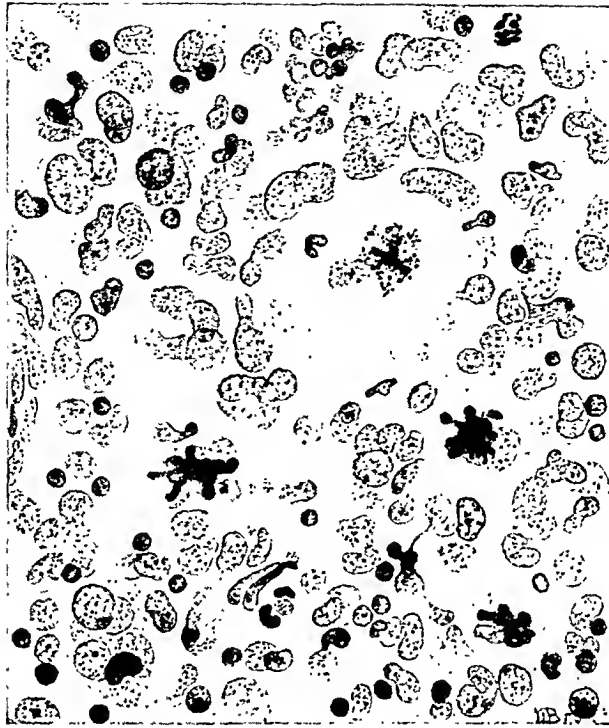


D

Brödel and Becker, fec.

PLATE IX.—PAPILLARY OVARIAN CYST WITH SARCOMATOUS NODULES.

A. Portion of great cyst wall, twice enlarged. In left lower corner typical appearance of a papillary cyst; in left upper corner and on right border, smooth but slightly undulating surface of cyst wall. Sarcomatous masses form domelike nodules. $\times 2$.



C

PLATE IX.—PAPILLARY OVARIAN CYST WITH SARCOMATOUS NODULES.

B. Cross section of A. On left, delicate papillary masses; in middle, a large sarcomatous nodule with smaller ones on each side. Note delicate papillary growths.

C. Highly magnified portion of sarcomatous nodule. To appreciate size of cells, contrast them with small, round, deeply-stained nuclei. Mononuclear leukocytes scattered throughout the tissue. Small black mass above center of field is horseshoe-shaped nucleus of a polymorphonuclear leukocyte. Majority of sarcoma cells have round, oval, or irregularly oval, rather deeply-staining nuclei; in nuclei, coarse and fine chromatin granules. Surrounding nuclei, variable amount of pale-staining protoplasm. In vicinity of right lower corner an almost circular protoplasmic mass with irregular, deeply-staining nucleus; to both ends of this, secondary nuclei are attached by delicate filaments. Scattered throughout the field are numerous similar cells, all showing karyorrhexis. A striking cell is above and to right of center, markedly irregular in contour, with a distinct nucleus, containing many coarse granules of chromatin. $\times 570$.

D. Sarcomatous nodule on section, magnified forty times, with papillomata on each side. Underlying connective tissue, poor in cell-elements, in sharp contrast to superficial sarcoma with abundant cells. Nuclei round or irregular; in pale-staining area large.

her menses had ceased abruptly. The abdomen, 145 centimeters in circumference, was enormously but symmetrically distended by an ascites lifting the walls so far from the spine that no tympany could be elicited below the umbilicus; superficial veins were distended and there was edema above the symphysis.

No tumor could be felt by the vagina, but by rectum an irregular, ill-defined growth, like a papillary mass, was found. After opening the abdomen and evacuating 17 liters of ascitic fluid, papillary cystic tumors of both ovaries were removed—the left side easily, but the right, after delivery from dense broad ligament, uterine, and vesical adhesions. On the pelvic floor and the rectum were numerous secondary deposits, eight of which were excised; others were left, covering a wide space. She was discharged in a month, rapidly improving.

One tumor consisted of several bluish-white cysts, translucent and yellowish in the dependent part, Figure 601. On the surface was the pink cauliflower excrescence seen in the figure, and inside the smooth-walled cysts were dotted with outgrowths of varying sizes. The cyst fluid was thick and tenacious.

Ascites is nearly always found and the cystic contents are watery, thick, syrupy, glutinous, or pseudomucinous.

A patient of Mary Sherwood, complaining of general weakness, with no localizing symptoms, returned within four months with a distended abdomen. An exploratory incision revealed the whole pelvis, true and false, choked with papillomata, beginning to break down extensively in the center. Enucleation was impossible; she died about a week later of an intense septic peritonitis caused by an abscess ruptured into the abdomen. A sister under my care had died of the same disease.

The papillary excrescences consist of connective-tissue framework covered by epithelium. An early stage shows only simple proliferation of the epithelium; as this pushes out from the surface and branches, again and again, the connective tissue follows, carrying the blood and lymph vessels.

In sharp and interesting contrast to these epithelial tumors stands a group of little tumors of the ovary with connective-tissue elements greatly in excess, appearing sometimes as a reddish mushroom excrescence on the ovarian

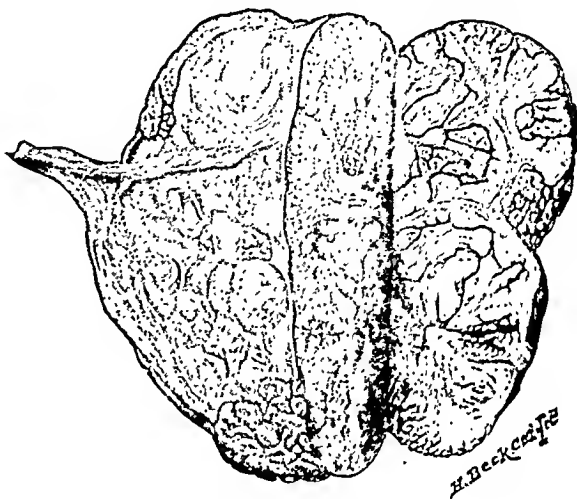


FIG. 601.—SOLID OR FIBROID PAPILLARY ADENOMA OF OVARY.

On section tumor consists of fibrous stroma enclosing alveolar spaces from 0.3 to 1 centimeter in diameter, completely filled with branching papillary masses. Color, pinkish-gray. Numerous adhesions. $\times 1$.

surface, apparently sprouting from a ruptured graafian follicle; the growth is well supplied with blood-vessels and made up of a mass of connective tissue with just enough epithelium to cover it. It is perhaps suitably named papillary fibroma.

The diagnosis of papillary tumor cannot be made when it is hidden inside an ovarian cyst. The practical conclusion is that every ovarian cyst is open to suspicion, quasimalignant, and, therefore, should be removed promptly. It is exceedingly dangerous to harbor monocystic and small, nodular, fixed ovarian tumors which are ever open to grave suspicion until they are removed and examined.

A probable diagnosis may be made when small irregular cystic tumors are found on both sides and adherent to the pelvic floor, especially if there is any ascites. They lack the density of a pelvic abscess and are harder and more irregular than a hydrosalpinx. It is possible sometimes to feel the papillary mass structure through the rectum and so to arrive at a pretty sure diagnosis; while a bloody, syrupy liquid withdrawn from the abdomen is suggestive of papilloma, we have not found any help from its microscopic examination.

When the disease has gone far enough to produce irregular masses felt through the abdomen with ascites, the diagnosis will rest between ovarian carcinoma and papilloma of the peritoneum. There seems to be no way to distinguish these clinically.

Associated and characteristic are the emaciation and the extreme weakness.

When the disease is masked by ascites, it can often be felt easily through the flaccid abdominal walls, after the fluid is evacuated by tapping.

Just here there is the risk of implantation in the track of the trocar. Usually it is better to make an incision about an inch long, to evacuate quickly, and then to explore with a finger and to wipe out the incision with alcohol and to close up.

One should avoid any but the gentlest palpation to avoid the risk of bruising or breaking off pieces of the growth and provoking hemorrhage. One large tumor was seen, which had such thin walls that it broke as soon as it was touched, through the incision, discharging a brownish fluid full of epithelial cells into the peritoneum.

Pseudomucinous papillary cystadenoma, resembling the classical polycystic ovarian cyst, is properly classified in that group. It is multilocular in arrangement but without the single large cyst so often found in the other cystomata, this being replaced by numerous small cysts containing pseudomucin of varying consistency and color. It usually has a well-defined pedicle and shows a tendency to bilateralism (over 50 per cent).

The papillary growths are mostly confined to the cystic spaces and more abundant at the pedicle.

The growth is slow and symptomless and benign in tendency, in marked contrast to serous papillomatous cysts and papillary carcinomata. In seven,

peritoneal implantations were found but once, in spite of the presence of the excrescences on the surface in several; in one with implantations, these were little nonpapillary glassy nodules, resembling those sometimes found with the common ovarian cystoma.

II. Malignant Epithelial Tumors.—*Carcinoma*.—Adenocarcinoma, the most malignant of all ovarian diseases, an epithelial growth, appears under several

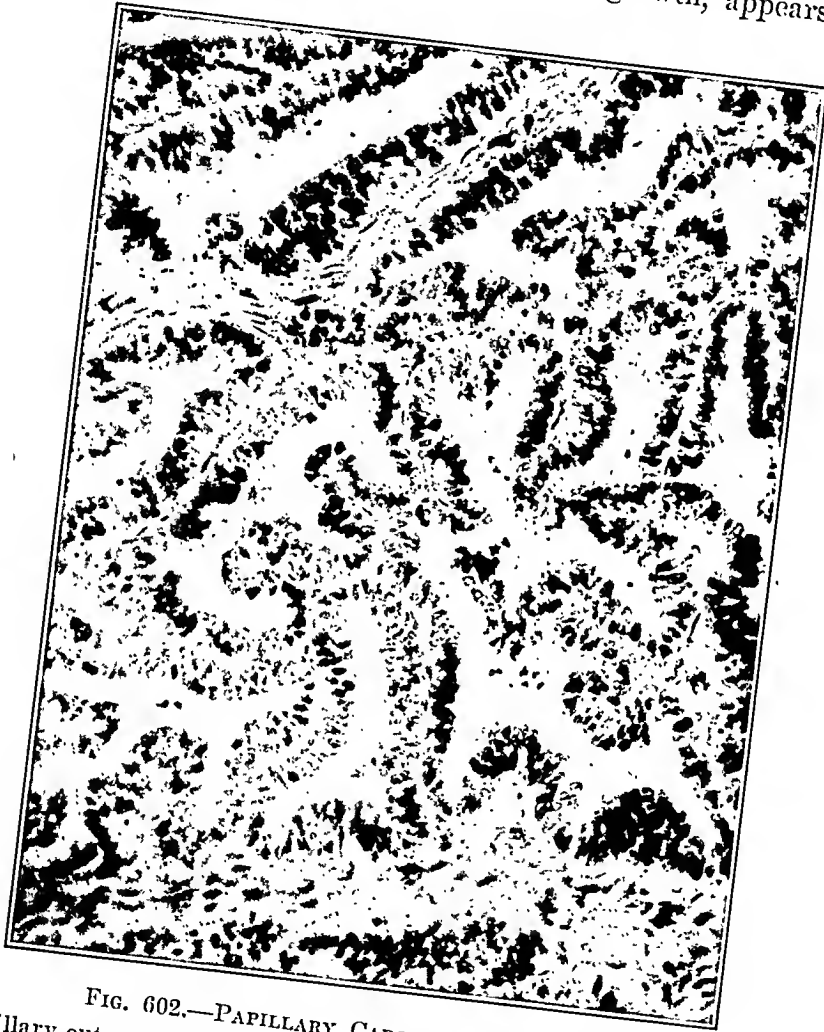


FIG. 602.—PAPILLARY CARCINOMA OF OVARY.

Irregular papillary outgrowths with little stroma covered with several layers of epithelium.
 X 200.

forms, either primary—in the ovary and constituting the original ovarian tumor—or secondary—either as a degeneration of a glandular ovarian cyst, a dermoid, endometrial cyst, or a papillary cyst, or metastatic from some other organ, such as the body of the uterus, the cervix, the stomach, or the colon.

The association of carcinoma with the glandular and papillary cystoma, although etiologically unexplained, seems a natural evolution in these histologically remarkable growths, characterized by an enormous proliferation of atypical “glandular” tissue.

The carcinoma appears in a solid scirrhous or cystic form and is found as well in the comparatively young and after the climacteric. The epithelium, cylindrical at first, becomes atypical, penetrates the underlying tissue, forms alveoli, and consists of many layers.



FIG. 603.—OVARIAN SQUAMOUS CELL CARCINOMA.

Strands and columns of squamous cells (1) running through modified ovarian stroma (2). Squamous lining (3) of cystic cavity from which carcinoma may have originated. $\times 50$.

Out of the group of ninety primary ovarian carcinomata, thirty-three were double and fifty-seven unilateral.

They vary in size from small growths, scarcely enlarging the ovary, to a mass as big as a man's head. The development is rapid, with metastases in various parts of the body by lymph and blood channels, invading and destroying the surrounding tissues. The omentum is a favorite seat for metastases; on

the intestine they often appear as round, white, hard, and flat-topped bodies variously grouped. As the disease advances, edema of the legs and cachexia appear.

Papillary Adenocarcinoma.—This group microscopically departs from the type in the size, form, and arrangement of the epithelial cells, whether upon

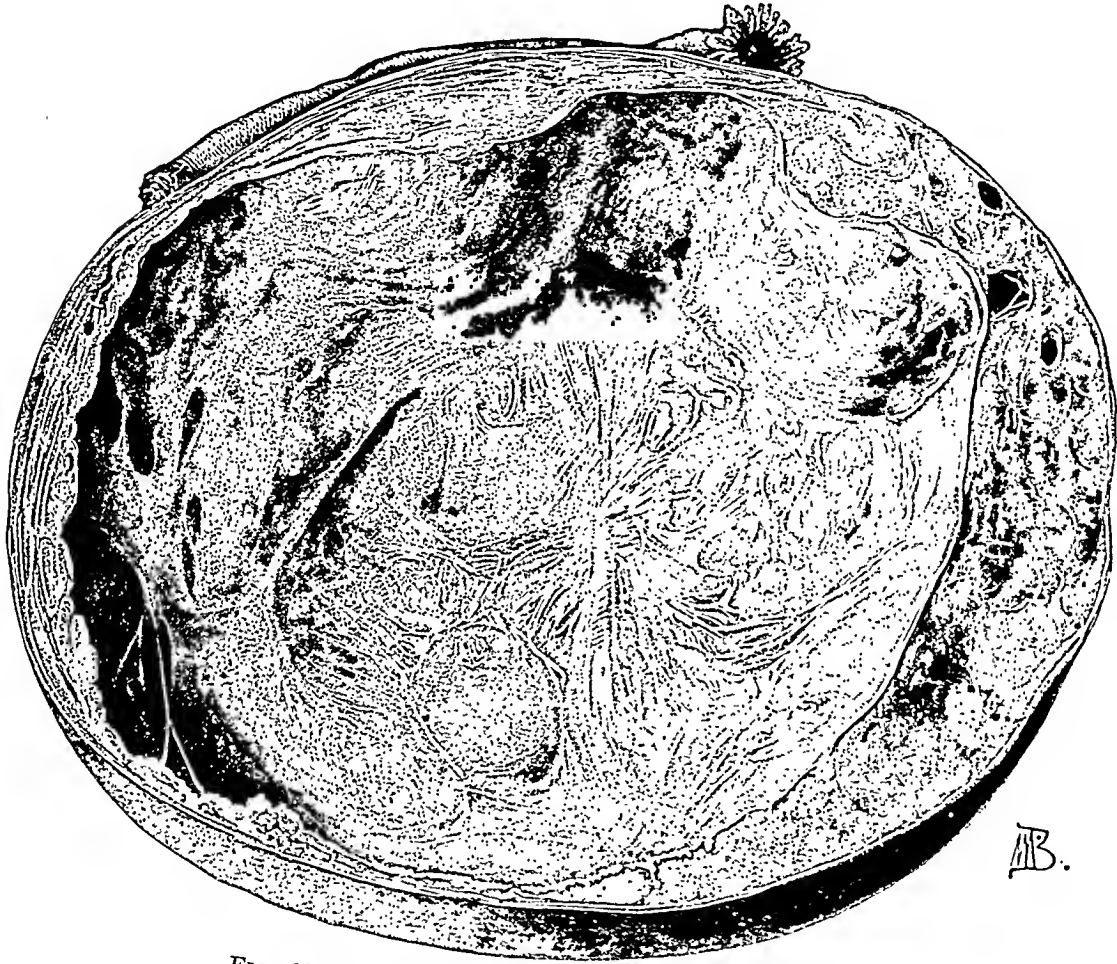


FIG. 604.—CYSTOCARCINOMA OF UNUSUAL FORM.

Walls thick; inner surface of large cyst smooth, irregular, nodular, and without epithelial lining. Uterine tube lies above. $\times \frac{2}{3}$.

the papillæ or on the inner surfaces of the cyst walls or within the walls of the tumor.

Pfannenstiel found that almost half of his adenocarcinomata were papillary, while in a group of twenty-seven of our own, but two appeared.

They were almost always cystic; one had a cystocarcinoma of one side and a superficial papilloma of the other.

There were proliferations in half both in the cysts and on the surface, without perforation or rupture; hard carcinomatous nodules are often felt in the cyst wall.

Half were more or less spherical and the remaining half, polycystic.

The microscopic picture is usually that of an adenocarcinoma; there is an occasional medullary carcinoma.

Metastases were observed in retroperitoneal and inguinal glands, in the uterine tube, uterine wall, stomach, liver, and pericosteum of the ribs, in six out of twenty. One had a double ovarian papillary cystocarcinoma with carcinoma of the cervix and a uterus containing numerous myomata. Peritoneal



FIG. 605.—ADENOCARCINOMA (COLLOID CARCINOMA) WITH NUMEROUS CARCINOMATOUS NODULES ON EXTERNAL SURFACE OF UNRUPTURED CYSTS; SECONDARY GROWTHS IN OMENTUM. $\times \frac{3}{4}$.

implantations were found in 30 per cent, partaking of the nature of the mother tumor, markedly malignant and widely distributed, penetrating the subjacent tissues. Cachexia is usual.

Peritoneal implantations occur when the papillomata appear in the interior of the tumor and the contents escape into the abdomen, as happened once during the operation when the patient died in a few months with a wide peritoneal involvement.

About 82 per cent died of relapse on an average of eight and a half months after operation, in sharp contrast to the simple adenomata where papillomata were left in the peritoneum and the average viability was three and a half years.

Papillary Cystadenosarcoma.—But two cases are recorded—Pfannenstiel's and one from the Johns Hopkins Clinic (T. S. Cullen, *Am. J. Obst.*, 1896, 34).

Pfannenstiel's patient was single, forty-seven; she had an extensive subperi-

toneal tumor, the size of a man's head, and died four months after its extirpation, without the possibility of determining whether she had a relapse. The tumor was cystic unilocular, with a wall 2 centimeters thick in one place where the surface was covered with numerous discrete papillary excrescences. On



FIG. 606.—LARGE ADENOCARCINOMA (COLLOID CARCINOMA) OF OMENTUM, SECONDARY TO CARCINOMA OF OVARY; FREE BORDER OF OMENTUM BELOW.

Operation removing omental mass. Recovery. Death some months later. $\times \frac{1}{3}$.

section, the tissue was homogeneous with some irregular, smooth-walled cavities and consisted of a vascular connective tissue interpenetrated with round and spindle cells. The delicate papillomata were covered with simple cylindrical epithelium in a single layer, sending glandular extensions into the underlying tissue. There was no discoverable connection between the papillomata and the sarcoma.

In the case in the Hopkins Clinic, a multilocular adenopapilloma was associated with sarcomatous nodules in the inner surface of one of the cysts. The patient, sixty-three years old, had a tumor first noted six months previously.

The cyst of the right ovary, about the size of a man's head, was removed close to the uterine cornu, and an uninterrupted recovery followed.



FIG. 607.—ADENOCARCINOMA OF OMENTUM, SEEN IN SECTION. $\times 1$.

MB.

Other Forms.—Secondary.—Secondary or metastatic carcinoma in the ovary reduplicates the primitive growth. A. Hempel records a case (*Arch. f. Gynæk.*, 8) in a woman of forty-two, with carcinoma of both ovaries, giving birth to a living child and dying a month later with purulent peritonitis. The ovaries were found converted into irregular nodular tumors larger than a child's head; the pylorus was the seat of an old carcinoma with perforation.

P. Reichel (*Ztschr. f. Geburtsh. u. Gynäk.*, 15) shows the unexpected possibility of metastases direct from a uterine carcinoma to an ovary, citing instances of uterine hemorrhages of long standing as clear evidence of the uterine carcinoma antedating that of the ovary. He urges that this is far from exceptional and should always be considered upon discovering an ovarian carcinoma.

A practical conclusion is that in the extirpation of a uterine carcinoma, both ovaries should be removed because of the risk of leaving an implantation too.

Krukenberg Tumor.—In 1895, Krukenberg described a peculiar malignant tumor involving both ovaries, which he named fibrosarcoma mucocellulare carcinomatodes, holding it to be a primary tumor occurring in both young and old, attaining considerable size with slow growth, maintaining the gross outline of the ovary, and metastasizing widely, with uniformly fatal outcome and with bilateralism as an outstanding character.

A section of the growth looks like a myxoma, often with liquefaction cysts and occasionally with distinct alveolar elements. Microscopically there are small groups and occasionally a diffuse growth of large rounded cells with mucinous contents, distending the cell and compressing the nucleus to one side so as to flatten and give it a signet-ring appearance. In the diffuse area, an abundant stroma is intermingled with these signet cells, suggestive of a connective-tissue origin. Lymph-gland metastases are common, especially the lumbar.

Apparently Krukenberg did not know of the metastatic carcinomata of the ovary from a primary focus in breast, thyroid, stomach, colon, rectum, and other abdominal organs, capable of producing just such a tumor as he described as primary. This evidence was furnished by Gloeckner, Wagner, Romer, Schlagenhauser, and others, also showing that the stomach is the commonest original focus.

As the stroma in this group is not neoplastic and moreover evidence is wanting to prove that the large signet cells are derived from the stroma, one must conclude that such growths, being largely secondary, are carcinoma and not sarcoma.

Clinically the diagnosis is made upon finding bilateral ovarian tumors, usually solid, coupled with the known existence of a primary carcinoma either



FIG. 608.—KRUKENBERG TUMOR.

1. Section of tumor showing glandlike arrangement.
2. "Signet" cells typical of this tumor.
3. Normal ovarian stroma.

× 250.

of the breast or of an abdominal viscus. The type is undoubtedly rare and is usually the outcome of a chance find at the operating table. The diagnosis is confirmed afterwards by the signet cells.

Mixed.—Quite often one finds a tumor of the ovary difficult to classify. One may be made up chiefly of cells resembling those in a hypernephroma; another seems to have originated in the lutein cells, whence the name luteoma; still another is mixed and has no doubt sprung from an embryonic cyst which has been swallowed up as it were by the carcinoma. Ewing's *Neoplastic Diseases* will help in classifying these rarer growths.

III. Embryomata.—Dermoid cysts and teratomata stand alone as a peculiar group originating from the three germinal layers.

Dermoid cyst is a tumor with some or all the elements of skin tissue, as well as bones, nerves, and mucous membrane, usually unilocular, and exhibiting more or less perfectly the epithelial layers of the skin with sebaceous glands, sweat-glands, and hair. Teeth are often imbedded in the cyst wall, sometimes attached to bone with a well-defined alveolar process resembling the lower jaw.

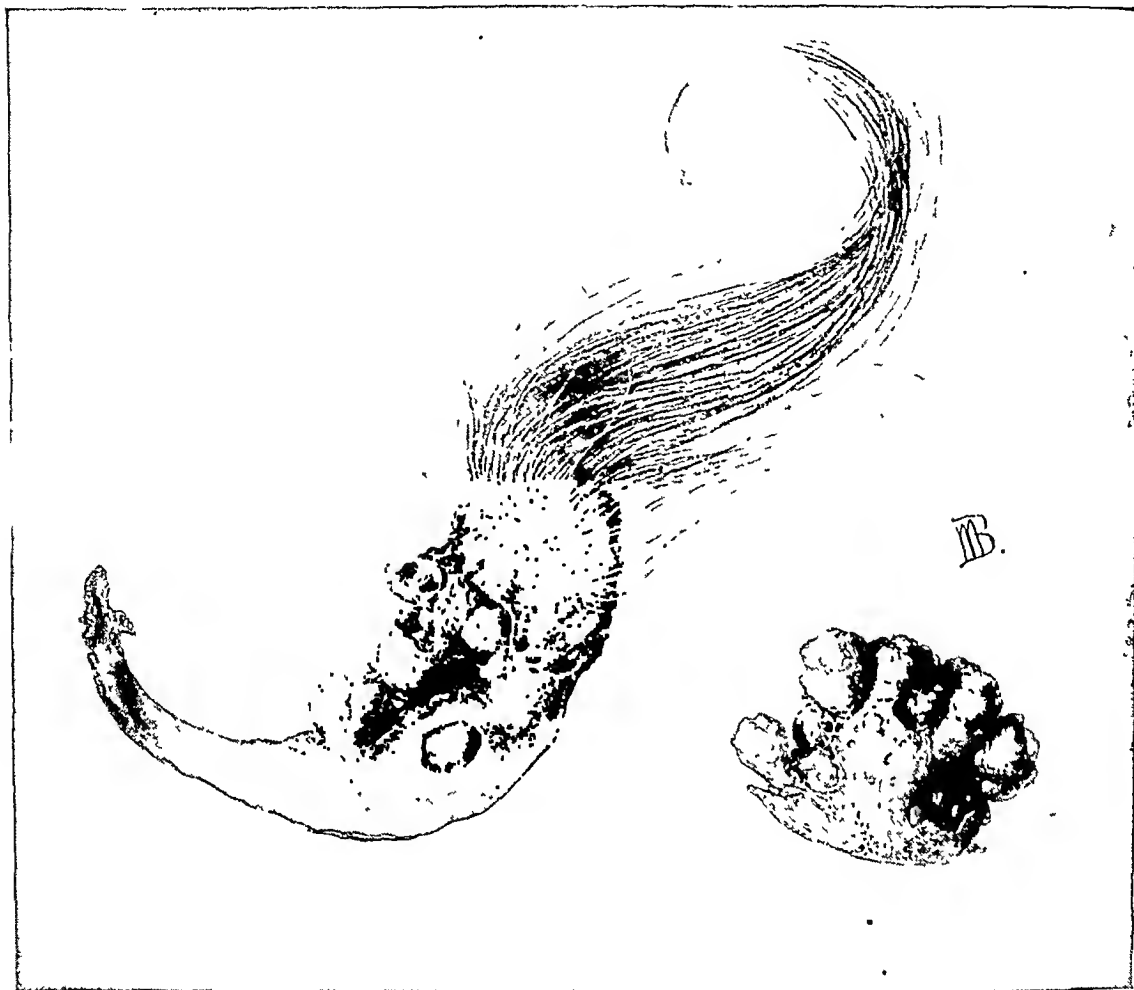


FIG. 609.—RUDIMENTARY JAW FROM DERMOID CYST CONTAINING MOLAR TEETH, WITH WISP OF BROWN HAIR AT ONE EXTREMITY.

On right another small piece of dentigerous bone loaded with molars. Case of Weist. $\times 1$.

Cartilage, nerves, and brain occur, and, in one instance, nail tissue. A mamma with a well-developed nipple is also found.

The outer covering is like an ordinary ovarian cyst; in its general relationships the dermoid cyst resembles a unilocular ovarian tumor.

The walls are lined by many layers of squamous epithelium, varying from a thin membrane, almost transparent, to one that is thick and leathery; the contents are oily, thick, greasy, and sometimes cheesy due to the secretions of the sebaceous glands and fatty degeneration of the epithelial cells. In extremely rare instances, in a large tumor, the fat is rolled up like butter balls about 2

centimeters in diameter; one such is recorded in the Johns Hopkins Hospital service. The color of the hair is light or dark, in no relation to that of the surface. It often occurs in large quantities, rolled up loosely in a ball, immersed in fat. The length of the hair is not usually over 2 feet. P. F. Mundé once reported it 5 feet long.

After removal, left standing in a cool place, the tumor becomes hard and deep yellow in color; the contents of a large cyst tend to deposit fine feathery cholesterol crystals on the surface.

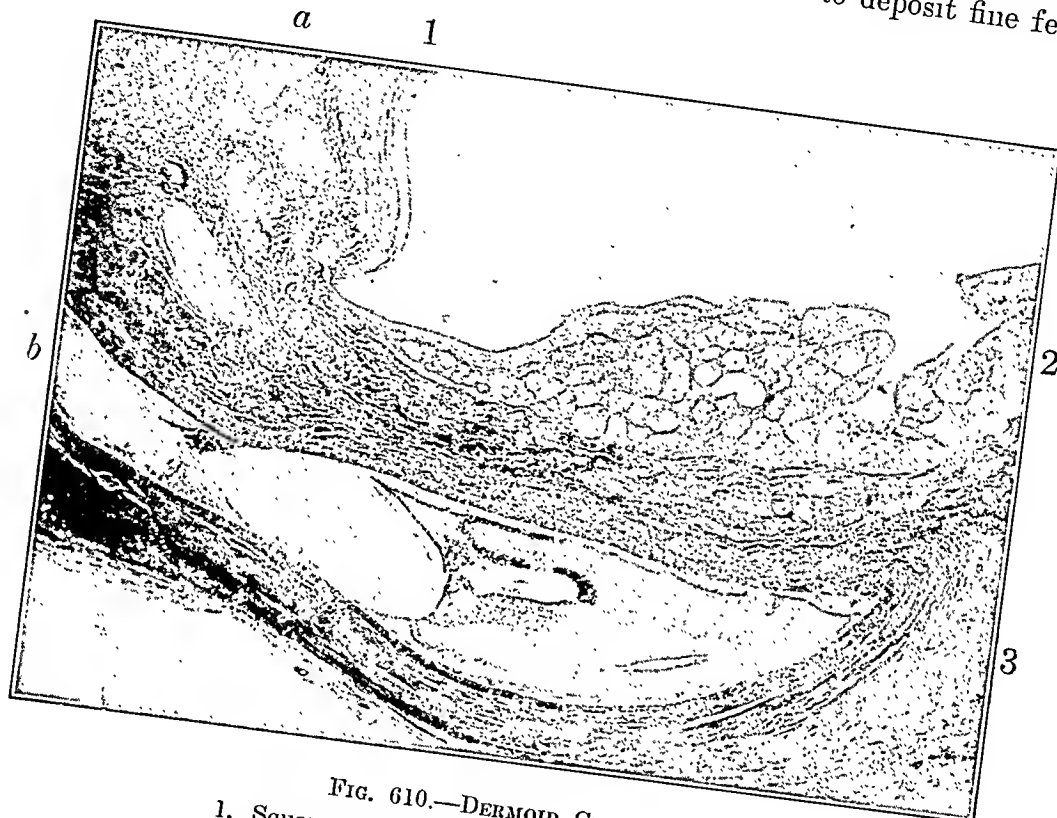


FIG. 610.—DERMOID CYST.

1. Squamous epithelium lining cyst above.
2. Sebaceous glands underneath cyst lining.
3. Enveloping ovary.
 - a. Corpus albicans.
 - b. Atretic follicle cyst.

× 50.

Dermoids are usually one-sided; in eighty-seven there was but one in both ovaries and one other with two cysts on the same side. Other observers note a larger percentage as bilateral.

In operating, if the opposite ovary is at all enlarged or shows any localized hardness within, it should be incised and searched for a concealed dermoid.

The clinical histories of eighty-seven show sixty-four married and twenty-three single. Of the sixty-four married, twelve were childless, but four reported miscarriages; forty-eight had borne children. The ages of nineteen varied from twenty-one to sixty, the average being thirty-five. The growth was slow in most; one had observed her tumor for ten years and others for six

or seven years. Such observations apply, of course, only to tumors large enough to push forward the abdominal wall.

The pedicle varies as in ovarian multilocular tumors; eight had distinct pedicles, seven had none, and one had a long pedicle twisted one and a half times.

Dermoids are prone to attacks of localized peritonitis, a tendency difficult to explain and seemingly inherent even in the smallest; indeed, these seem to be the worst as they are often found buried in dense adhesions. On the other hand, a cyst as large as a head may be entirely free. Eight out of nineteen

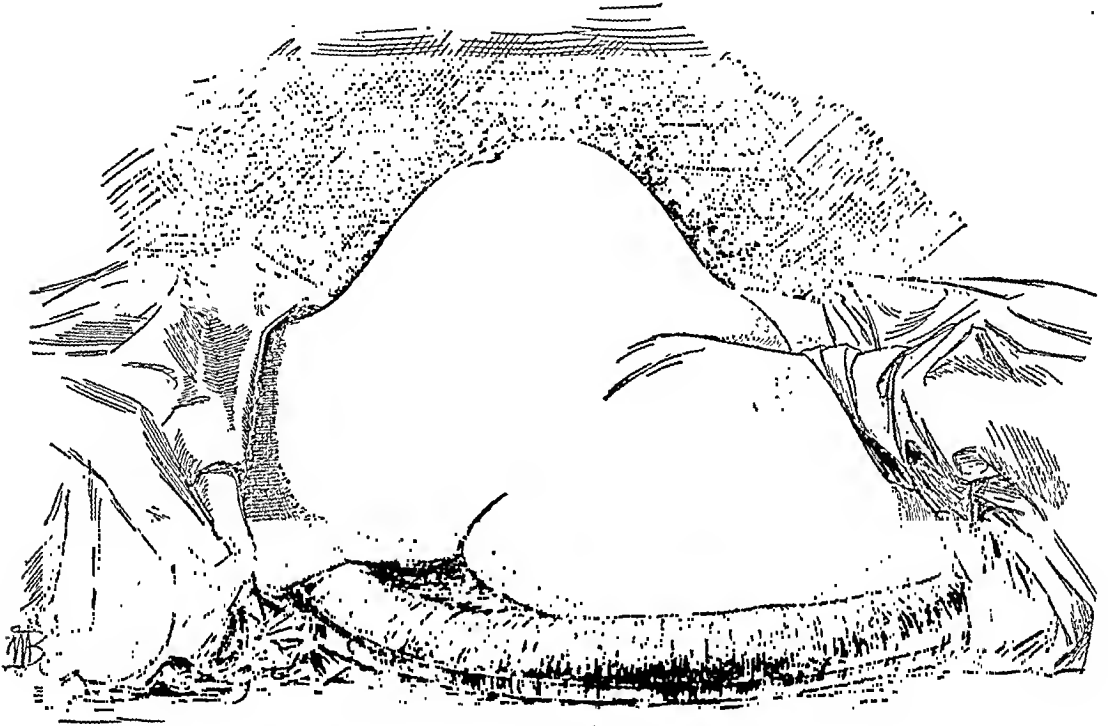


FIG. 611.—CONTOUR OF ABDOMEN IN UNUSUALLY LARGE DERMOID CYST.

had no adhesions; the remaining were more or less anchored by adhesions varying from slight velamentous to the dense fibrous. This liability to peritonitis often involves the other ovary and tube by contiguity, binding them down, Figure 612.

Like the ovarian cystoma and an occasional myoma, a dermoid cyst may almost completely sever its natural vascular supply and become parasitic through its adhesions, Figure 613.

The menstrual history is only characteristic by reason of the severe dysmenorrhea. Three nonadherent cases had no actual pain but a distressing bearing-down. About half had vesical distress from frequent micturition to severe tenesmus. There is often marked emaciation. One lost 40 pounds in six months, during which time the abdomen attained a circumference of 92 centimeters.

The prognosis, if the tumor is neglected, is bad because of the pain, pressure, and the liability to malignancy.

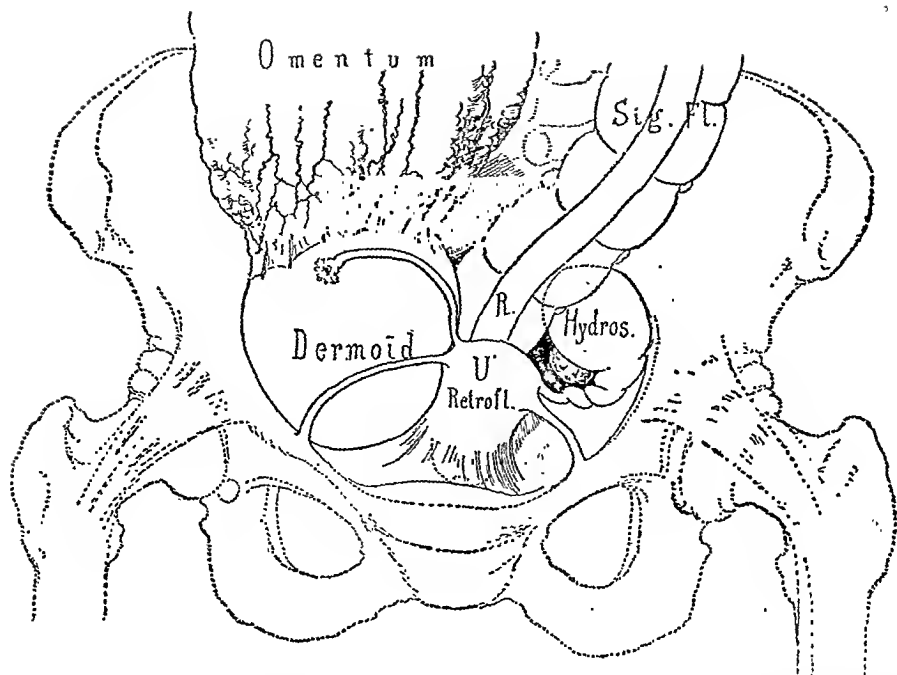


FIG. 612.—COMPLICATED DERMOID CYST OF RIGHT OVARY, WITH DENSE ADHESIONS OVER ENTIRE BREADTH OF OMENTUM WITH DISPLACEMENT OF RIGHT TUBE AND ROUND LIGAMENT.

Uterus dragged up (ascensus uteri); on left, large hydrosalpinx.



FIG. 613.—RIGHT DERMOID CYST (D) WITH EXTENSIVE ADHESIONS.

Note displacement and atrophy of right tube and adhesion to and angulation of left tube.
 $\times \frac{2}{3}$.

Suppuration is not uncommon, even advancing to perforation of the bladder or bowel. Hydronephrosis and pyelitis often ensue from pressure at the pelvic brim or below it.

The differential diagnosis may be puzzling, the chief difficulty lying in dis-



FIG. 614.—FIBROMA OF RIGHT OVARY WITH TWISTED PEDICLE AND ASCITES.
Patient, age fifty-three. Operation, right salpingo oophorectomy. Recovery.

tinguishing the dermoid from a polycystic tumor, and the difference in consistence being no aid since the contents of the dermoid are often liquid and appear about as fluctuant as water.

A larger dermoid, more or less spherical and usually unilateral, gives the impression of a monocyst; its growth has been slow. If the patient is young, the chances in favor of a dermoid over an ovarian cyst are increased but with

the reserve that the likelihood of sarcoma is then greater. A dermoid is more likely in the colored races.

Where attended with inflammatory sequelæ, it is painful on pressure. Küster states that a dermoid is more likely to float out in front of the uterus and in close contact with the abdominal wall. An ovarian tumor, not rotated and the seat of an active inflammation with elevated temperature, is apt to be a dermoid. The occasional cases in which hairs appear in the bladder (pilimic-

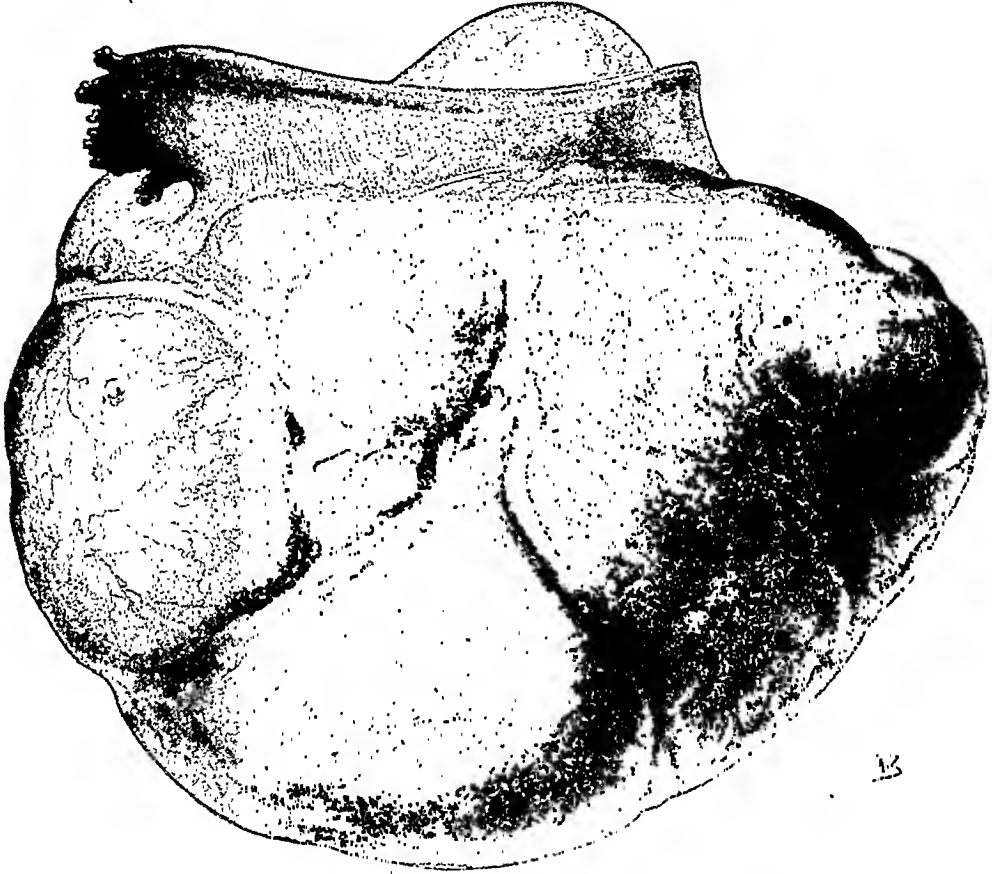


FIG. 615.—FIBROID TUMOR.

Coarse enlargement of ovary, with numerous sulci and vessels coursing over surface from hilum. Uterine tube and mesosalpinx seen above. $\times \frac{2}{3}$.

tion) and rectum, of course proclaim the diagnosis. An x-ray in a number of instances ought to show the shadow of bone or teeth. A tendency to emaciation must have its weight. Once the diagnosis was made unexpectedly by a vaginal puncture, thinking the fluctuating sac choking the pelvis and bulging into the vagina was an abscess. The discharge of fatty matter at once revealed the true nature of the case.

In small monocystic tumors in the pelvis, the dermoid must be listed for differential diagnosis. When the tumor is adherent, when there is a history of pelvic pains lasting some years, and when the walls of the tumor are evidently thicker than those of a graafian follicle cyst, a probable diagnosis may be made.

Teratoma is closely allied to a dermoid and is often called an embryonic or, again, a malignant dermoid. It is solid and usually grows rapidly, manifesting its malignant character by widespread metastases.

The teratoma contains meso-, ecto-, and endo-dermal elements, and is conglomerate in appearance; the component elements are never isolated as in a dermoid but exhibit a wild type of cell growth and proliferation.

The clinical course is that of any malignant ovarian tumor, aside from the fact that it appears in younger women and in girls. A differential clinical separation from ovarian carcinoma is practically impossible; the elucidation must come from the laboratory.

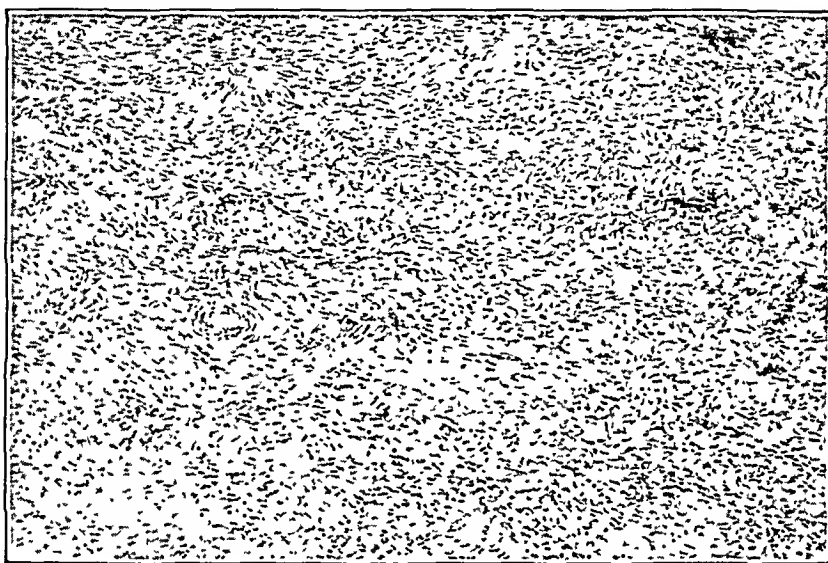


FIG. 616.—FIBROMA.

No normal ovarian stroma. Tumor composed of compact fibrous tissue with scattered small blood-vessels. Entire tumor stained red with Van Gieson's stain, showing absence of nuclear fibers. $\times 100$.

IV. Connective-Tissue Tumors.—*Fibroma* is among the rarest of pelvic tumors and characterized by an indefinite multiplication of all the connective-tissue elements of the ovary at the expense of the other histological components. The mass thus becomes a fibroid ovary which may further contain degeneration cysts, dilated blood spaces, and lymph-spaces, Figure 614.

The warp and the woof of the intimate elements make for extreme density. At times almost bony, it is white or pinkish and covered with smooth peritoneum and lobed by deep and shallow furrows, Figure 615. It is never bedded like a uterine fibroid in such fashion that it can be shelled out. There is no line of demarcation from the ovarian stroma. Calcification is rarely found, usually in small masses of phosphates and carbonates of calcium. A large one is described by J. W. Williams (*Tr. Am. Gynec. Soc.*, 1893, 18) in which the tumor of the right ovary was 7 by 6 by 5 centimeters, weighed 220 grams, and was like ivory. A calcified corpus luteum was found on the dissecting table,

in an aged negress; it was spherical, white, spiculate, about 1 centimeter in diameter; when the shell, about 1 millimeter thick, was broken, the smooth interior was found filled with a watery fluid.

A specimen, Figure 617, from G. S. Peck of Youngstown, Ohio, is an almond-shaped ovarian calculus, partly enveloped in a thin fibrous capsule, microscopically composed of fibrillated tissue, poor in nuclei, with calcareous particles scattered through it. The stone, itself, is made up of chalklike material, containing a large amount of calcium phosphate, with traces of the oxalate and carbonate of calcium, magnesium phosphate, and organic matter (Aldrich).

In the first ten thousand gynecological admissions at the Johns Hopkins Hospital, there were ten large fibroid ovaries and three small calcified tumors. Loehlein found seven in 172 ovarian tumors; Orthmann has described pure myomata.

Ascites is usually present, except when the growth is small, and forms one of the striking characteristics. It was noted in all the above but one where the tumor was only as big as a walnut. Four out of ten with a large ascites had been tapped before entering the clinic. In one, the ascites persistently returned in spite of five tapplings done to relieve the severe dyspnea; she was thought by competent medical authority to have an advanced cirrhosis of the liver. There is usually no pain referable to the tumor.

As pointed out by T. S. Cullen, the ascitic fluid is caused by partial torsion of the ovarian vessels. The patient usually applies because she has noticed a lump or solely because of the ascites.

The slow growth goes on for years; the average size is that of one or two fists, but August Schachner had one in a negress of thirty-five, weighing 14 pounds (*Am. J. Obst.*, 29).

Diagnosis is made by noting the hard pelvic tumor lateral to the uterus and attached by a pedicle to the broad ligament and accompanied by ascites, without cachexia. In five out of ten, the age was over fifty, the average being forty-eight. In four with large fibromata, not past the menopause, there was either amenorrhea or excessive menstruation.

The small tumor in Figure 618 was a fibroid of the ovary, almost chalky white, with a few fine superficial vessels, associated with a little pedunculated fibroid of the utero-ovarian ligament, a small subserous uterine fibroid, and pelvic inflammatory disease.

Sarcoma is one of the rarer tumors; the sarcoma diagnosed upon a purely clinical basis usually proves to be a fibroma. They are usually spindle-celled. Other varieties are angio- and carcino-sarcoma. They are either cystic or solid.

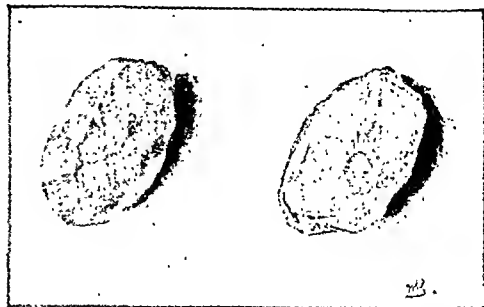


FIG. 617.—CALCULUS OF OVARY, SEEN ON ITS TWO SURFACES.

Case of G. S. Peck. $\times 1$.

The gross appearance, like the fibroma, may resemble a coarse hypertrophy of the ovary, ovoid, often flattened and lobulated. The surface is usually smooth, whitish, bluish, or flesh-colored, often traversed by large veins and sticking to surrounding structures. Softer tumors of brainlike consistence tend to rupture and bleed freely, even on the most gentle handling. On section, the more solid tumors appear white, pink, or yellow from fatty degeneration;

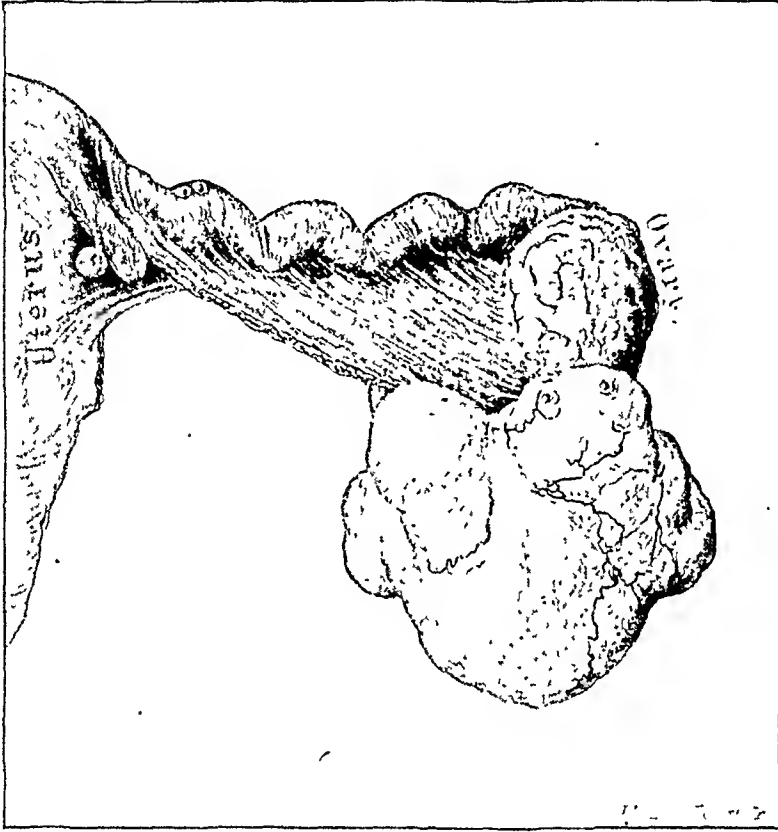


FIG. 618.—PARTIALLY CALCIFIED FIBROMA OF RIGHT OVARY.

Tumor springs from inner ovarian border and is dense, chalky, and white, with a few vessels on the surface. Small fibroma of utero-ovarian ligament detached from ovary. Viewed from behind. $\times 1$.

hemorrhagic areas are common, small cyst cavities are often present. In a child of twelve, the brainlike solid elements lay at the hilum, and the capsule of the ovary was floated up by an accumulation of fluid escaping into the abdomen through a small opening. The spindle-cells lie in irregular bundles radiating in every direction.

In an angiosarcoma the cells lie concentrically around the thin-walled blood-vessels.

It is not always easy even microscopically to differentiate sarcoma from carcinoma of the ovary.

Sarcomata of the ovary are the commonest of the large tumors in youth. Bland Sutton collected twenty under fifteen years of age; a girl of twelve, the

youngest, had a cystosarcoma and died of recurrence about a year after operation. On the other hand, out of one hundred ovarian tumors in women over seventy, there was one sarcoma. In thirty-six collected by Olshausen, five were under twenty, nine were between twenty and thirty, eighteen between thirty and forty, and four between fifty-eight and sixty-seven. In younger patients, the round cell predominates, the spindle-cell becoming commoner later. The chief characteristic is rapid growth, ascites, and obvious loss of health.

A cystic sarcoma may be soft enough to rupture under moderate pressure

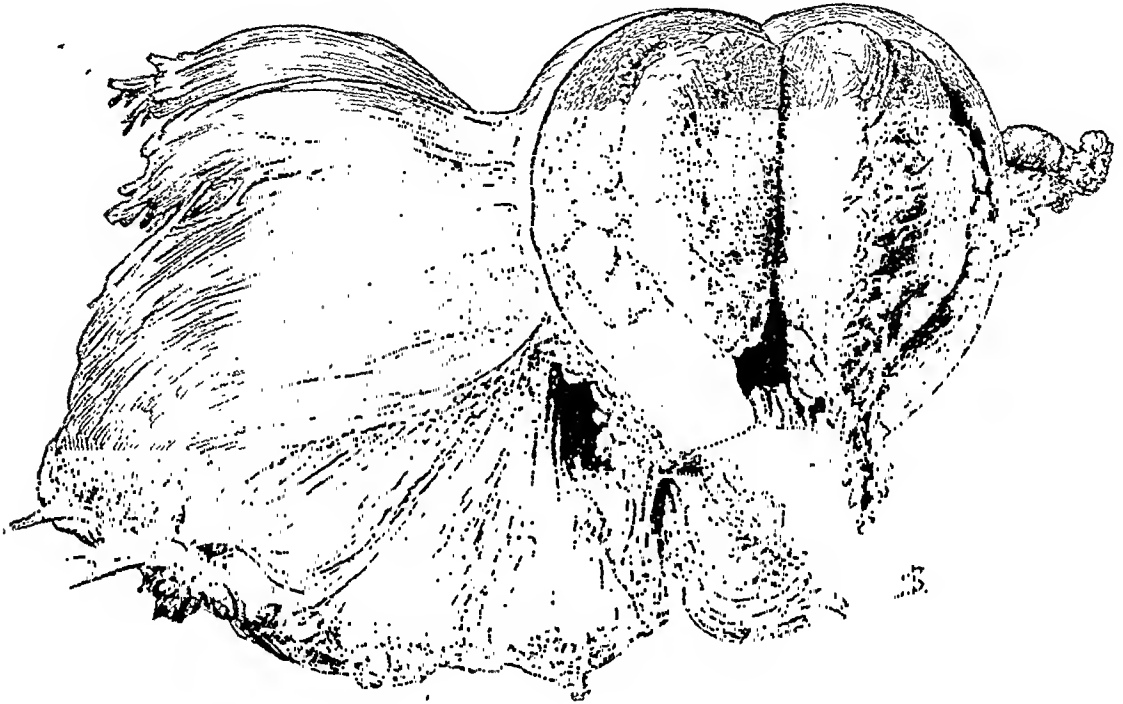


FIG. 619.—ANGIOSARCOMA OF LEFT OVARY WITH METASTASIS INTO UTERUS.

Ovarian tumor on left side intimately adherent to uterus, and made up of fibers running parallel. Uterus thrice enlarged; walls are twice normal thickness and studded with irregular lobulated and prominent round masses of waxy appearance. Portions of unaffected right ovary and tube seen to right of uterus. $\times \frac{1}{2}$.

in examining. In one, an extensive hemorrhage occurred from just such a rupture, and the patient was barely saved by a prompt operation with an infusion.

Metastases distributed through the veins are found in the stomach wall, peritoneum, pleura, and intestines, while the tumor spreads rapidly by continuity and contiguity, until broad ligament, uterus, and surrounding parts are hopelessly infiltrated and death brings relief from exhaustion.

One patient, Figure 619, the mother of two children, had had a grinding pain for six months in the left ovarian region and noticed a growth. A large firm bilobate angiosarcoma of the left ovary with enlargement of the superficial veins was found, apparently continuous with the uterus. This was so adherent in the pelvis that it could not be completely detached, but tore out in peculiar

parallel fibers. The enlarged uterus was invaded by continuity and apparently by metastases in globular, polypoid, and fingerlike masses. The ovary was reniform, 16 by 10.5 centimeters, and consisted of a series of light red and pale fibers like muscular tissue; in the center of each fiber was a blood-vessel with an inner lining of endothelium; in places, a muscular coat with eight to ten layers of spindle-cells immediately surrounded it, lying parallel to the vessel. The uterine mucosa was intact. She recovered to die some months later of the continued growth.

PAROVARIAN CYSTS

Parovarian cysts originate in the tubular remains of the embryonic wolffian body, between the layers of the mesosalpinx, Figure 620, between

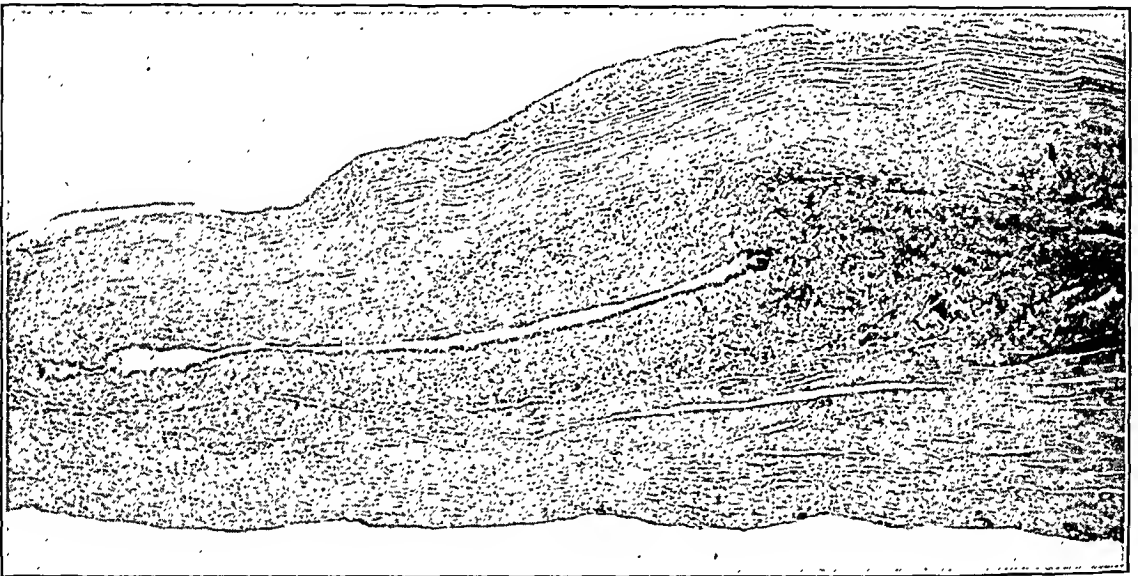


FIG. 620.—PAROVARIAN TUBULES.

One large and several smaller parovarian tubules lined with cuboidal epithelium and surrounded by layer of smooth muscle. Slight cystic dilatation of larger tubule. Externally fibrous tissue of parovarium. $\times 20$.

uterine tube and ovary; continuing to grow, they either form free pedunculate tumors rising up into the abdominal cavity or thrust themselves down between the layers of the broad ligament and then up into the abdomen or lie wholly behind the peritoneum. In 576 tumors of the ovarian group, twenty-one were parovarian, three of which were bilateral.

The tubules of the parovarium, 1 millimeter in diameter or less, are readily seen by holding the mesosalpinx up to the light while separating tube from ovary. Histologically, the tubules are surrounded by two layers of spindle-cells which are apparently nonstriped muscle-fibers; the lining is one layer of cuboid or low cylindrical epithelium often ciliated.

The cysts vary in diameter from a few millimeters to 20 or more centimeters.

Small ones may be multiple, but large ones are almost invariably single. They are usually almost transparent, smooth, and glistening, Figure 622. As the peritoneum is but loosely attached to the cyst wall by a delicate stroma, it slips over the surface of the tumor. The peritoneal blood-vessels take a direction different from the vessels of the tumor proper, two well-defined vascular networks crossing each other. The cyst walls are usually thin and may contain calcareous plates; the inner surface is whitish or pinkish in color, smooth, and glistening; papillary masses are sometimes found on the inner wall.

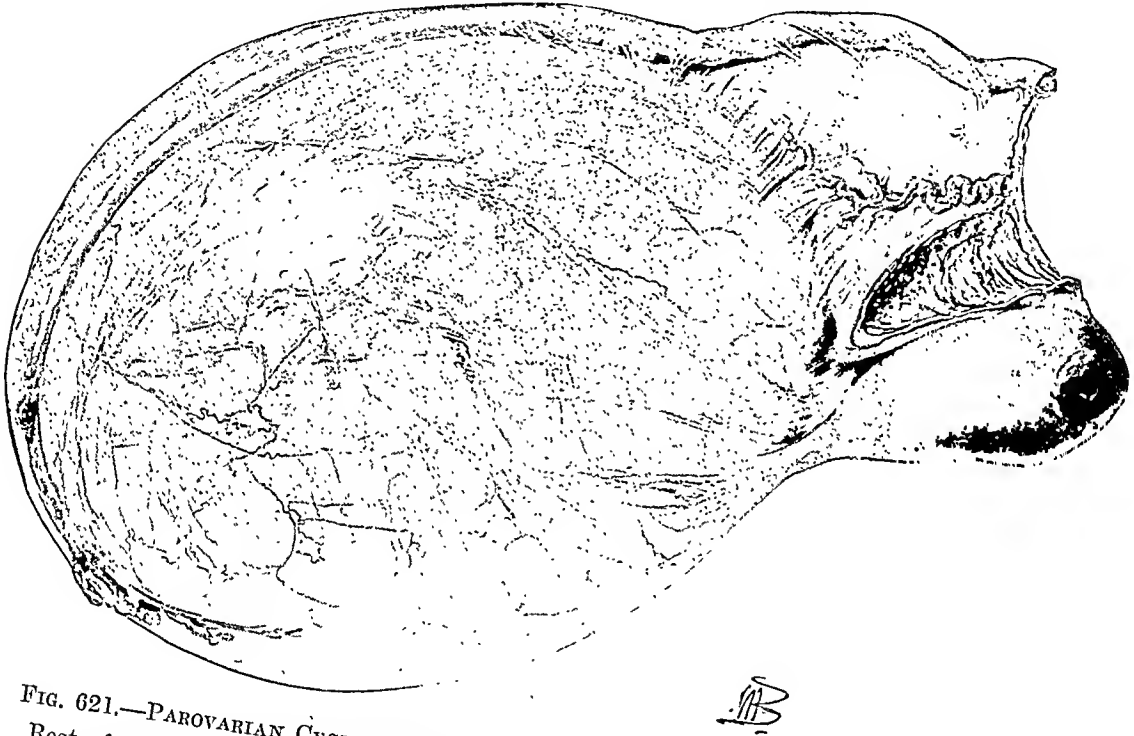


FIG. 621.—PAROVARIAN CYST BETWEEN AMPULLA OF TUBE AND OUTER END OF OVARY. Rest of mesosalpinx intact. Ovary shows recently ruptured corpus nigrum. $\times 1$.

The fluid is poor in albumin, pale and limpid like water, its specific gravity varying from 1.004 to 1.006. When masses are papillary or when a hemorrhage has taken place, the specific gravity is higher and the color brown, blackish, or yellow.

Orth almost invariably found cilia at some point or other, whether the cyst was large or small. The overstretched uterine tube may reach 40 or more centimeters in length with its fringed end deployed, greatly protracted, and spread apart. The ovary often forms a flattened, easily recognizable prominence on the convexity of the cyst. It may, however, be taken up in the cyst walls. Both tube and ovary, apart from the flattening, are histologically normal. Out of 410 cystic ovarian tumors of all kinds, fifty-six, including all broad ligament cysts, were parovarian. The average age was thirty-nine; the oldest being

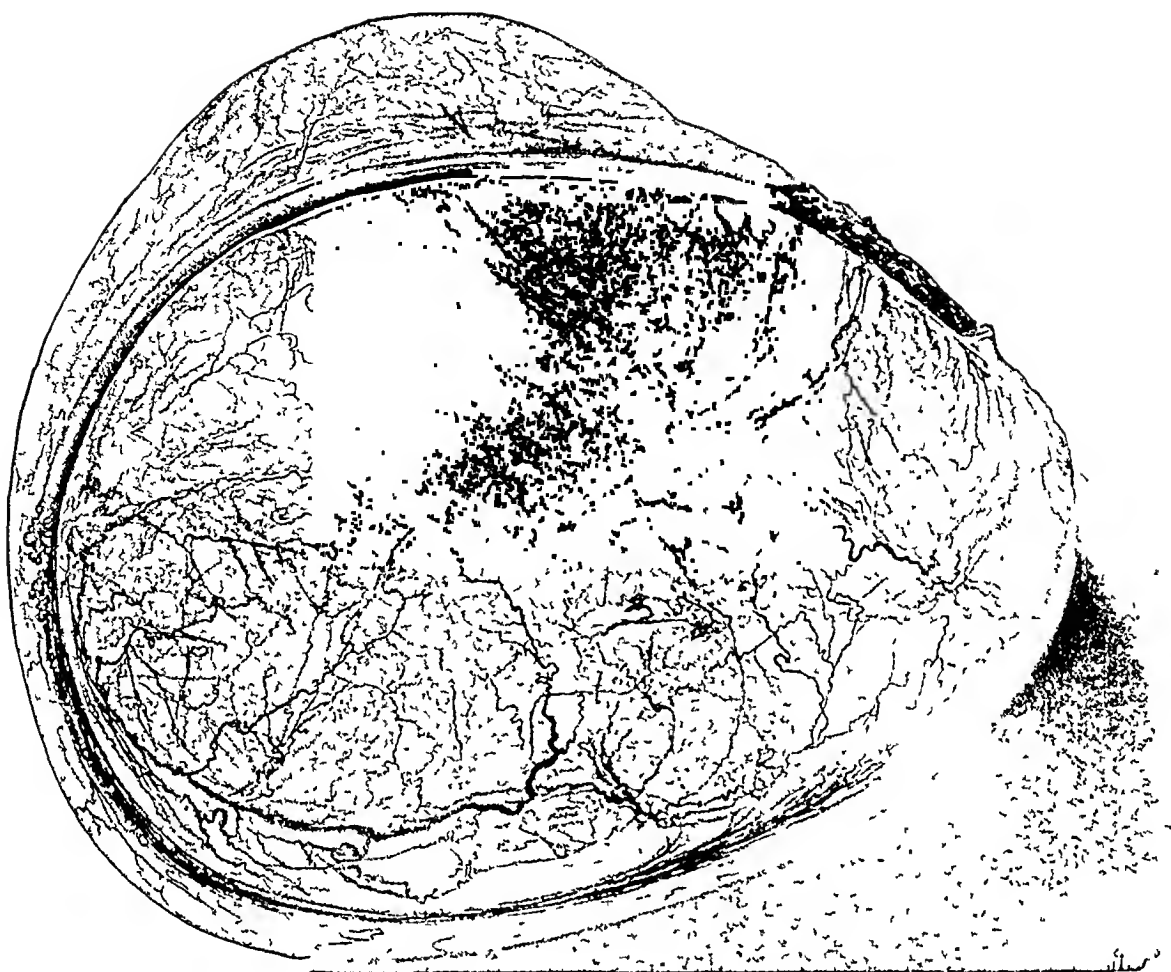


FIG. 622.—PAROVARIAN CYST, SHOWING TRANSLUCENCY AND CHARACTERISTIC RELATIONS OF UTERINE TUBE, GREATLY LENGTHENED AND SPREAD OUT ON SURFACE OF CYST.

No mesosalpinx; fimbriated end pulled out longer than tube itself, describing an arc. Note double set of vessels, superficial and deep. Pedicle at area uncovered by peritoneum on right upper surface. Slightly irregular surface seen on outline just to right of pedicle is ovary spread out on tumor surface. $\times \frac{1}{2}$.

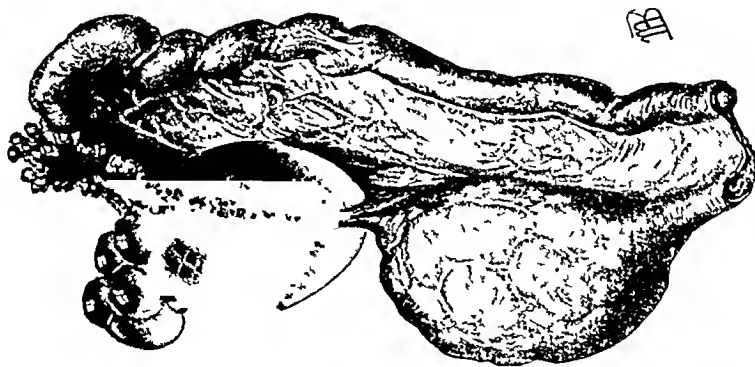


FIG. 623.—PAROVARIAN CYST WITH SUBSIDIARY CYSTS LYING BENEATH TUBO-OVARIAN FIMBRIA, WEIGHING DOWN FIMBRIATED END OF TUBE, AND SEPARATING IT FROM OVARY, SEEN ON RIGHT, UNDER ISTHMUS OF TUBE. $\times 1$.

seventy-five and the youngest, eighteen. The majority were about thirty-five. The average number of children to the married women was 3.5.

The cyst is commonly under the outer extremity of the uterine tube, separating the fimbriated end from the ovary as the tumor grows and acting as an efficient cause of sterility. In one instance there were two cysts, 2.5 centimeters in diameter, in front of the tubo-ovarian fimbria, and a third of 3 centimeters at the uterine end of the tube. Small cysts are usually sessile, situated obviously between the broad ligament folds. One, however, about

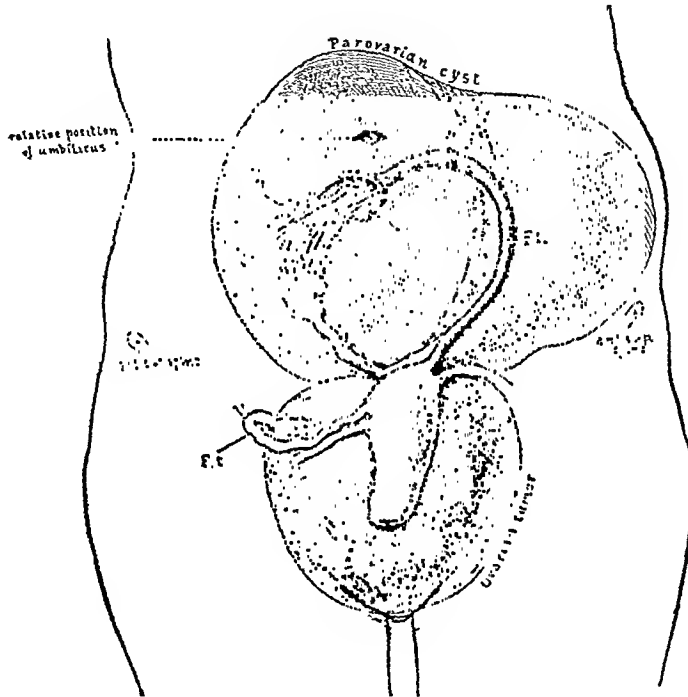


FIG. 624.—OVARIAN AND PAROVARIAN CYSTS OF SAME SIDE.

Above large, translucent, lobulated tumor. Lower tumor unilocular ovarian with thick walls. Operation. Recovery.

3 centimeters in diameter, had a pedicle 1.5 centimeters long under the fimbria. Utero-ovarian ligament and uterine end of the tube are never widely separated even when the tube is 43 centimeters long, as in one.

The growth is slow and the cyst is flaccid oftener than an ovarian monocyst.

The pedicle may be several centimeters long, occupying the breadth of the broad ligament. A long pedicle may undergo torsion, as in ovarian tumors. A remarkable instance, involving the tube and producing a hemorrhagic infarct of both tube and cyst, is shown in Figure 627.

Prominent symptoms necessitating operation are the inconvenience of size and pain, described in all but three as dull and bearing down or paroxysmal and sharp. Adhesions were found in most.

The diagnosis is made by recalling the fact that growth is slow; the surface is smooth without bosses of secondary cysts; it is not tense like an ovarian cyst;



FIG. 625.—PAROVARIAN CYST BULGING OUT ON BOTH SIDES OF TUBE AND ATTACHED TO ISTHMUS BY BANDS OF ADHESIONS.

Tubo-ovarian fimbria splinted over surface of cyst; on its upper surface an accessory tube with two pedicles. Hydatid well-shown; ovary lies intact beneath tumor. $\times 1$.

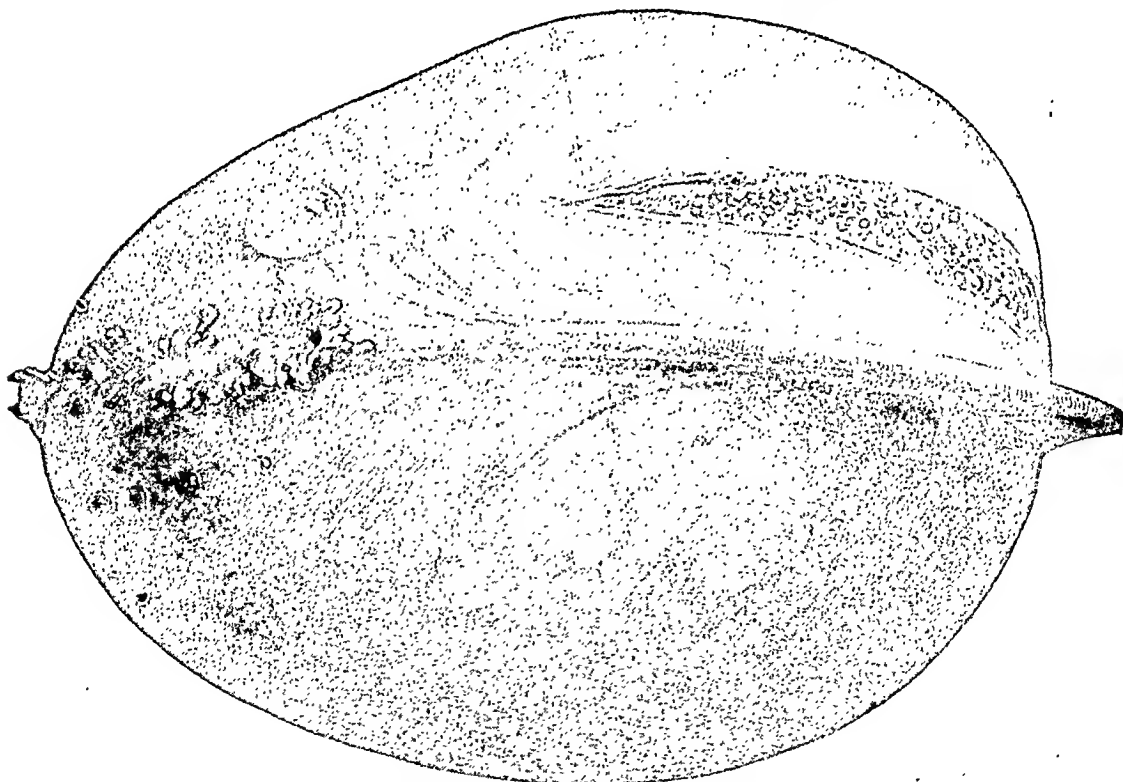


FIG. 626.—PAROVARIAN CYST.

Mesosalpinx spread out on both sides of tumor, which is developed more in its outer part, widely separating tubal ostium from ovary. Hydatid seen above. $\times \frac{3}{4}$.

when large, it is symmetrically disposed in the abdomen which is flattened or cylindroid. The percussion wave is less sharp than in a tensesly filled sac and conveys the impression of a single sac with thin walls.

On opening the abdomen, the clear monocystic accumulation of serum of an encysted peritonitis must not be mistaken for parovarian or other cysts. A large bleb of this sort is shown in Figure 628.

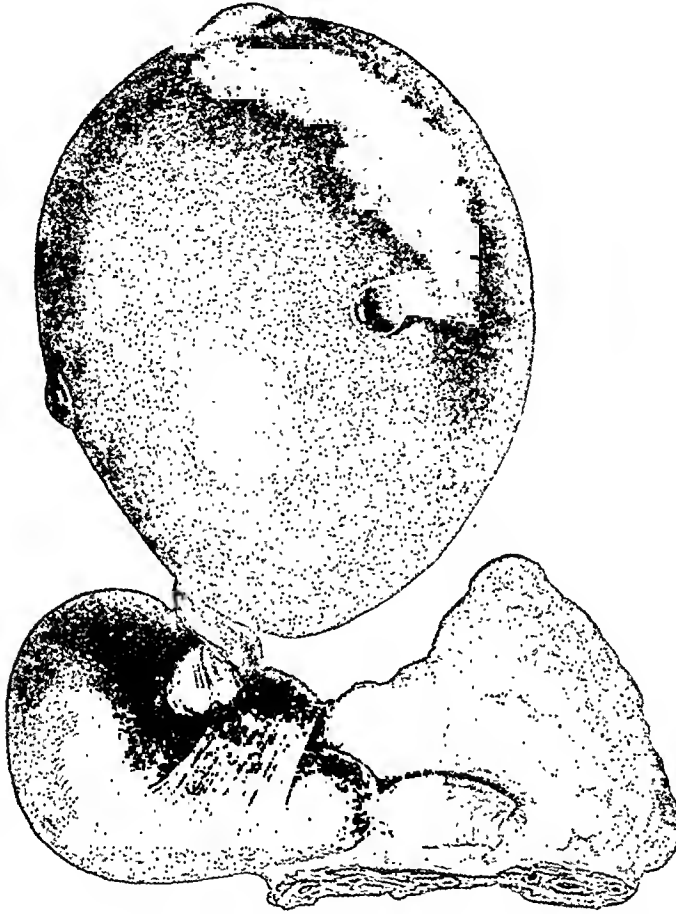


FIG. 627.—PAROVARIAN CYST WITH TWISTED PEDICLE; WITH HEMORRHAGIC INFARCTION OF THE UTERINE TUBE.

Ovary intact, together with small portion of uterine end of tube. $\times 1$.

Papillary parovarian cyst is rare; the monocystic papillary cystadenomata, however, are undoubtedly often registered as parovarian cysts under a habit of ascribing all monocystic tumors to the parovarium without critical examination.

Pfannenstiel found three parovarian papillary cysts in forty-eight papillomata; two were unilocular and thin-walled, as large as a uterus at term. The cyst contents were typical of parovarian tumors, and the ciliated epithelium inside was well preserved. The papillary masses are usually small and few. In two out of the three, the tumors had existed for twelve years; there was no evidence of malignancy in any instance.

HYDATID OF MORGAGNI

Hydatids of Morgagni (*appendix vesicularis*, Kossmann), while not strictly belonging to the ovarian tumor group, like the parovarian cysts, are naturally associated with it for important clinical reasons.

A variety of interesting affections of the little pedunculate vesicular organ which hangs from the anterior surface of the broad ligament at the end of the longitudinal canal of the parovarium, sometimes known as the hydatid of

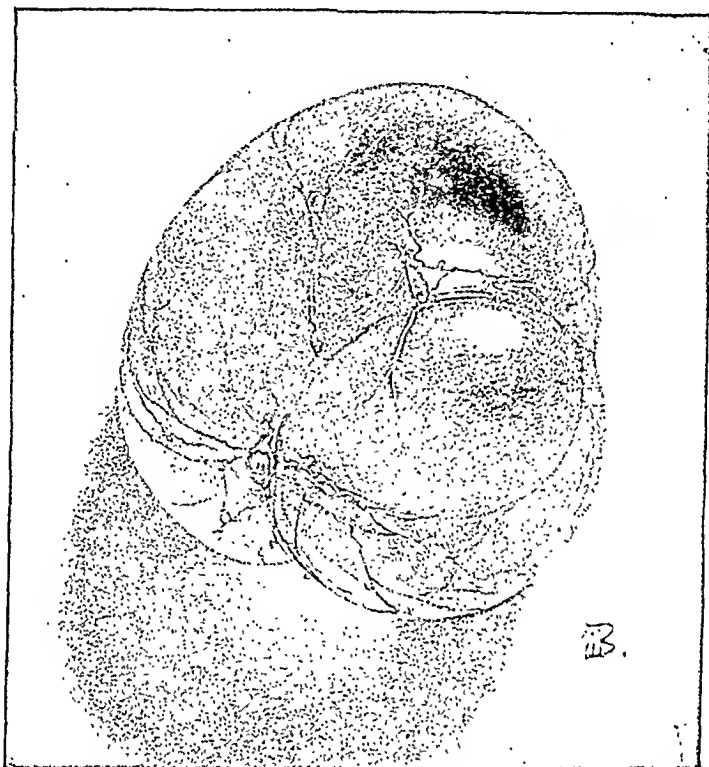


FIG. 628.—SUBPERITONEAL CYST DEVELOPED ENTIRELY FROM PERITONEUM.
Type of cyst frequently met in pelvic inflammations. $\times 1$.

Morgagni, have been noted. There was not one with any condition likely to interfere with health. The little organ, sometimes ovoid, sometimes spherical, is about 8 millimeters in diameter; again it appears as two vesicles fused with a slight constriction between them, in which lie the tiny vessels and some of the pedicle tissue. The length of the pedicle varies from nil when sessile to 10 or 12 centimeters, the average length being about 3 centimeters with a thickness of 2 millimeters expanded at the base. Long pedicles are often almost thread-like. Little vessels are always seen ascending the pedicle and distributed over the pellucid surface of the diminutive body. When the pedicle is long, it is often found hanging over the tubo-ovarian fimbria, between the tube and the ovary, explaining the following condition twice seen. The fimbriated end of the tube had adhered to the tubo-ovarian fimbria, except at a point close up under the tubal orifice, where the pedicle of the hydatid passed under it; by pulling on

this pedicle it could be drawn to and fro for about a centimeter, with a movement suggesting the trochlear muscle of the eye, the vesicle being free on the other side.

Several times the pedicle has been found tied in a single knot about its middle without interfering with the circulation. In one ovarian cyst, the pedicle of the hydatid was found tied around one of the fimbriæ of the uterine tube, which was dead white in appearance; there were a few adhesions around the pedicle at the point of constriction; the vesicle itself was wanting, Figure 629. The condition is explained as follows: A loose knot was made by the movable organ on its long pedicle; one of the fimbriæ fortuitously slipped into

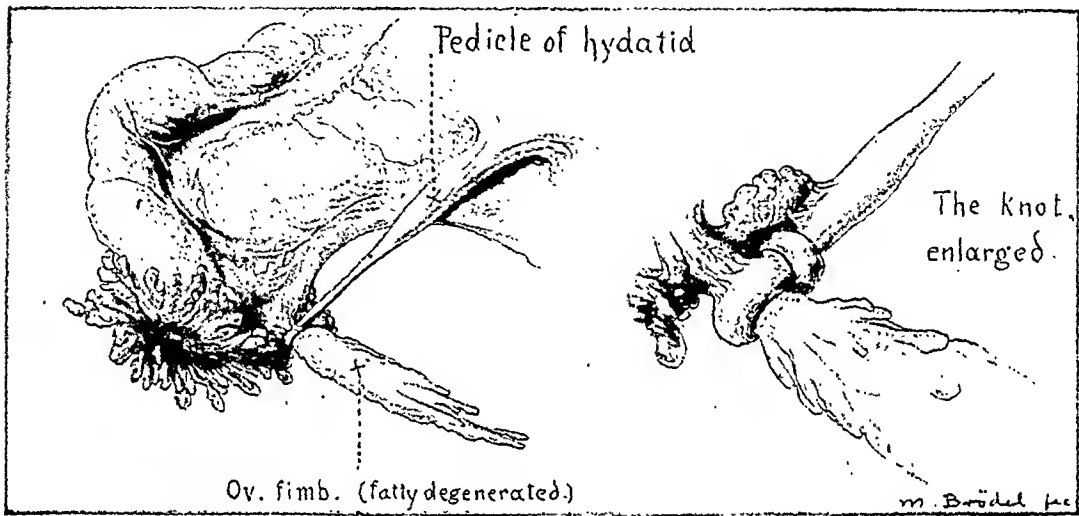


FIG. 629.—PEDICLE OF HYDATID TIED AROUND FIMBRIA; SHOWING ALSO APPEARANCE OF WHITE FATTY DEGENERATED FIMBRIA.

Right figure shows adhesion to pedicle and knot; enlarged.

the loop as it was pulled up by the hydatid and caught and strangled; the vesicle, and the distal part of the pedicle, also strangled, dropped off, leaving the knot as found fixed by a little adhesive peritonitis. In one there was a hemorrhagic infarct of a large left hydatid with a long pedicle several times twisted and almost severed. In another, the long pedunculate left hydatid was adherent to the sigmoid flexure above the pelvic brim, forming a large loop, like a long band of lymph.

INFLAMMATORY CYSTS

This group is excluded from discussion here, being fully considered under gonorrhea and tuberculosis.

Clinical Course.—The tendency of all ovarian tumors is continuous growth, filling first the posterior quadrant of the pelvis of the side from which they spring, then the whole pelvis, rising into the abdomen and gradually encroaching upon it from below upward.



FIG. 630.—MULTILOCULAR OVARIAN CYST IN A NEGRESS.
Aspiration. Death without operation. Autopsy.

Small tumors displace the uterus, first pushing it to the opposite side, then, with further growth and traction on the pedicle, drawing it toward the side to which it is attached; if the uterus is adherent it may be pulled up into the abdomen with the tumor (*ascensus uteri*).

The bladder is displaced, first becoming gibbous then expanding up into the abdomen or forced down into the vagina in a multipara; small adherent tumors or larger ones pressing on the pelvic floor and brim often compress the ureters and cause hydro-ureter usually of low grade. The rectum also is compressed, and in the large tumors the other intestines are crowded up under the ribs and out at the sides, and digestion is interfered with.

The largest tumors push out the abdominal wall in every direction and hang pendulous or spread out the ribs like great wings (*alate chest*). Women thus afflicted often have marked edema of the legs and suffer so from the weight and from dyspnea that they keep to the bedroom and are sometimes even compelled to live sitting up in a chair to be able to breathe, Figure 630.

Diagnosis.—In diagnosing an ovarian tumor, three questions are propounded:

1. Is there a tumor? This is usually easy to answer by a vaginal examination, which reveals a well-defined mass or cyst lateral to or behind the uterus; if it is large, it is often only too obvious and can be felt and outlined by percussion of the abdomen.

Patients constantly mistake tympany for a tumor and on appealing for a decision almost invariably add that the "tumor" is large at times and then grows smaller. Occasionally tympany does simulate to an extraordinary degree the configuration of an abdomen carrying an ovarian cyst, but a little palpation, demonstrating the uniformity of the resistance in all parts of the abdomen and a few resonant percussion taps over the "tumor," dispel the illusion.

In the rare event of an ovarian tumor containing gas and therefore tympanitic, a discrimination between this and intestinal tympany will be made by the evidently grave condition of the patient coupled with a significant vaginal examination which reveal the tense cyst wall and its relations to the uterus.

It is often hard to find the polycyst in a fat woman, where the examiner may mistake a mass of fat for a tumor; furthermore, a tumor of medium size with a pedicle easily escapes observation.

The rule is never to conclude that there is a tumor until indisputable evidence is secured and it is clearly felt on palpation and outlined by percussion and above all until its connection with the broad ligament, and so, indirectly, with the uterus, is manifested by a satisfactory pelvic examination. Where there is doubt, never express an opinion at a single examination. Frequently what was missed at first appears obvious at the next visit! Anesthesia, gas, with ether at times, is a *sine qua non* where certainty is not attainable; this gives an opportunity to examine both uterus and broad ligaments minutely

through the emptied rectum. Outlining and palpating normal ovaries negative a tumor diagnosis.

Occasionally an ovarian tumor, as large as one or two fists, with a long pedicle, slips into the abdomen and hides in the flank where it escapes observation unless systematically sought for in this locality, palpating both flanks between the hands as well as having the patient walk around and then examining her standing and immediately upon lying down.

2. Is the tumor ovarian? The differential diagnosis of an ovarian from all the other lower abdominal tumors must be effected by the discovery in the particular case of characteristic features and by noting the absence of those features peculiar to other growths. The method of diagnosis will vary according as the tumor is small and intrapelvic or large, from the size of a child's head upward.

The ovarian tumor is dull on percussion all over its convexity, while it is surrounded by a corona of resonance above and laterally; it is dull below on the pelvic side, the dull area pointing to its habitat.

The cystic ovarian tumor is attached to the broad ligament by a pedicle which can at times be felt *per rectum*; it replaces the normal ovary of the side from which it springs. It is displaceable downward but is limited in an upward excursus.

Upon finding a normal ovary on one side and none on the other, but in its place a tumor, the diagnosis is relatively certain.

When the conclusion is reached that a tumor is pelvic, its nature may be difficult to determine. A differential diagnosis must then be made between the ovarian and the various uterine and retroperitoneal tumors, not forgetting an overdistended bladder. A patient brought a long distance for operation had nothing but a distended bladder, and was relieved at once by a catheter! Again, all preparations were made to extirpate a big parovarian cyst, but it proved in the nick of time, just before operation, to be an overdistended bladder. There is something characteristic about the very appearance of an overfull bladder, which forms an elongate medial ovoid more markedly prominent just above the symphysis than any similar ovarian tumor. A bimanual examination of such a "tumor," palpating between the anterior vaginal and the abdominal walls, will immediately arouse suspicion in one of experience. An invariable custom of passing a catheter just before operation will prevent mortifying mistakes.

Retroperitoneal tumors are usually unyielding and fixed by a broad base, and their nature becomes evident if the rectum is much displaced.

Pregnancy and uterine tumors are often confused with ovarian growths, but such mistakes can occur but rarely if in every instance in a careful bimanual examination the uterus is outlined, especially resorting to anesthesia when there is a lingering doubt.

A tuberculous encysted peritonitis may resemble an ovarian cyst, but there

is an indefiniteness of outline about the enlargement, and peculiar, irregular areas of tympany and dulness, and slight mobility; moreover, the areas of dulness are apt to vary from time to time. A crinoline tracing helps to detect slighter variations. Tubercles can sometimes be felt through the thin rectal wall, and the temperature is usually elevated.

A large cystic kidney may rarely extend from diaphragm to pelvic floor, closely resembling an ovarian tumor. It must, however, be borne in mind that the kidney is very unilateral and reaches up under the ribs of one side and has the tympanitic displaced colon in front of it.

Small ovarian tumors lie to one side of or behind the uterus, usually evidently cystic and fluctuant, movable, and distinct from the uterus with which the connection can be traced by the utero-ovarian ligament. The difficulty is greater when the growth adheres to the uterus; the tumor is, however, usually lateral and fluctuant, and, in addition, the firm uterine body can be outlined independently; careful palpation also shows slight independent mobility. The puzzle of a fecal mass or a scybalous nodule, felt *per vaginam*, is at once resolved by a rectal examination.

Ovarian tumors of medium size, from a child's head to a uterus at term, are often best differentiated by outlining the other abdominal and pelvic organs by palpation and percussion to exclude their participation and then by grasping the cervix with a tenaculum forceps and pulling it down, by which means perceptible traction is made upon the tumor; again, the cervix is grasped and pulled well down toward the outlet, while the tumor is pulled simultaneously up into the abdomen when the forceps held lightly is seen to ascend in the vagina. This demonstration of the presence of a tumor is the most dramatic and illuminating of all the signs. A fibroid tumor moves the forceps at once and the forceps move the tumor, while in an ovarian tumor there is an interval before the pedicle is taut and pulls. In case of a suspected fibroid, do not pull the cervix down before handling the tumor.

A tubal tumor is thin-walled, elongate, or sausage-shaped; differentiation is not always possible.

Ascites is sometimes taken for an abdominal tumor, and a mistake is likelier when a malignant pelvic tumor is overlooked. When ascites is due to a pelvic tumor, a mass will be felt *per vaginam* or *per rectum*, while the ascites gives the usual signs in the abdominal examination.

3. What kind of ovarian tumor is present? In general a cystic tumor is easily distinguished from the solid by the obvious resistance of the latter and by its association with an ascites.

Among the cystic tumors we have to distinguish the cystadenomata (the common multilocular ovarian cysts), cystic papillomata, dermoid cysts, par-ovarian cysts, cystic carcinomata, and cystic sarcomata.

A multilocular cyst is often distinguishable by the eye alone. The chief difficulty arises when a polycyst, with one large cyst, follows its natural tend-

ency to rotate in order to adapt its contour to the concavity of anterior abdominal walls. A polycyst often feels thicker on palpation, and its contents seem more viscid; a careful search in the flanks sometimes reveals irregular bosses, and a vaginal examination, a conglomeration of cysts. Differences in tension are also revelatory.

Small superficial papillomata are sometimes recognized by excrescences felt by vagina or rectum, as well as by the association of an ascites with a small fixed tumor. When the pelvis is choked and there is ascites and discrete nodules



FIG. 631.—LONG PEDICLE OF PAPILLARY OVARIAN ADENOCYSTOMA.

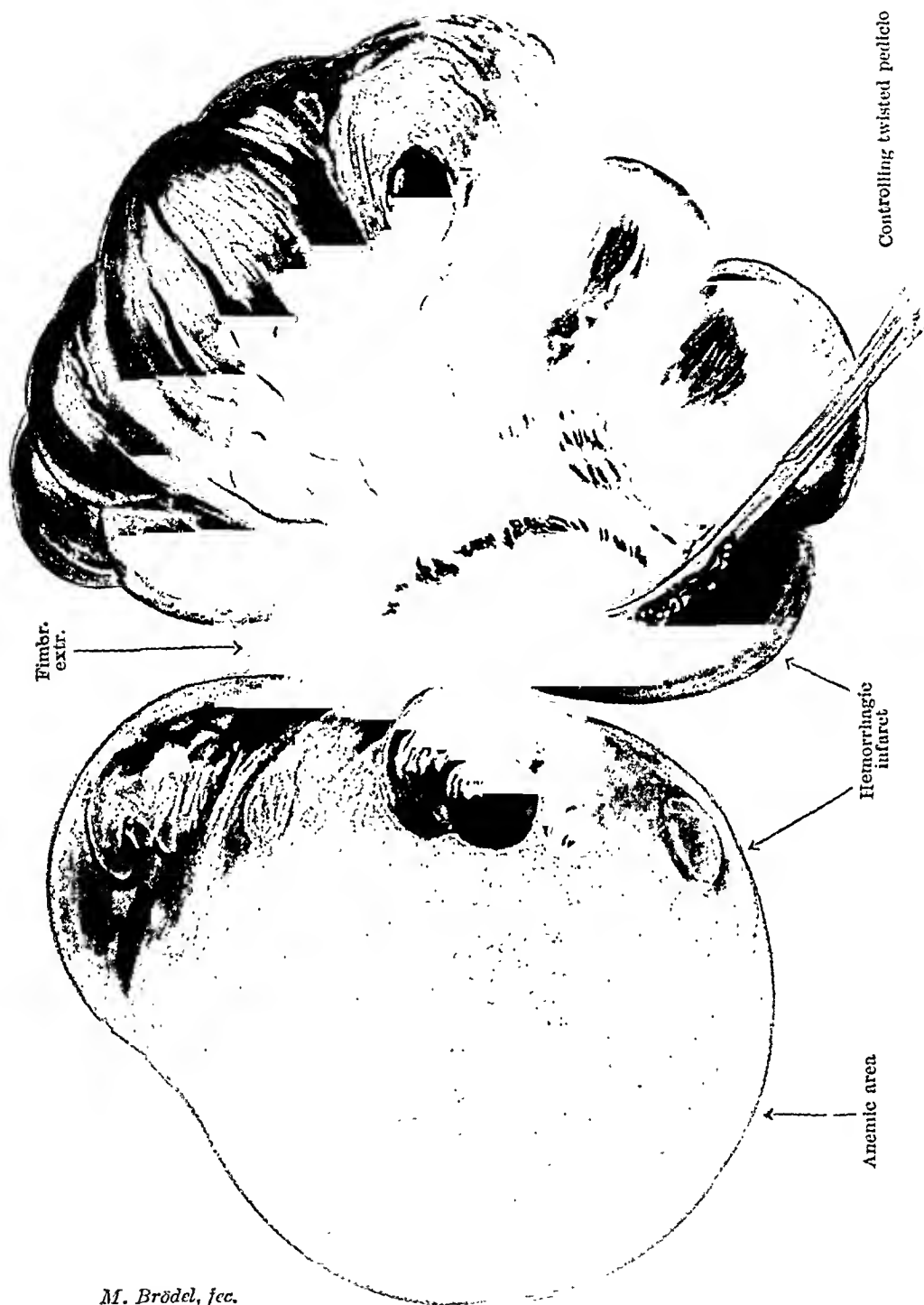
Tube above, with cyst (hydatid of Morgagni) under its fimbriated extremity. $\times \frac{3}{4}$.

(implants) are felt, especially in the omentum, there need be no doubt as to the nature of the trouble.

Küster asserts that a dermoid tumor tends to float up in front of the uterus; it is also a tumor of slow growth, usually monocystic, rarely very large, commoner in children and young women, and painful at times.

A parovarian cyst both to touch and by its uniformity is plainly unilocular and thin-walled.

Cystocarcinomata and cystosarcomata are unilocular cysts, often with thick resilient walls; in their earlier stages they are without characteristic features, but later, ascites, emaciation, and cachexia, and, it may be, metastases supervene.



M. Brödel, fec.

PLATE X.—HEMORRHAGIC OVARIAN CYST.

Large cystic tumor with pedicle twisted half way around, causing hemorrhagic infarction occupying two-thirds of cyst wall. Hemorrhage also into some of the cystic loculi. $\times \frac{1}{2}$.

Among the hard tumors, we differentiate the solid carcinomata from fibromata and some sarcomata.

A fibroid is single, dense, and movable, with ascites and without constitutional depression, in marked contrast to the loss of appetite and strength, the emaciation, cachexia, and edema often noted in the malignant group.

The carcinoma usually involves both ovaries, is more or less fixed and hard and nodular.

Metastases are, of course, pathognomonic.

Complications.—*Rotation of Pedicle.*—Ovarian tumors are attached to the broad ligament by the anatomical structures supporting the normal ovary which become the more or less lengthened pedicle.

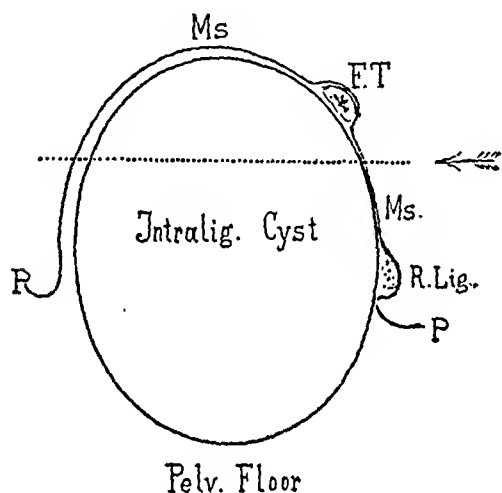


FIG. 632.—DIAGRAM OF RELATIONS OF AN INTRALIGAMENTARY CYST TO ANTERIOR AND POSTERIOR LAYERS OF PERITONEUM OF BROAD LIGAMENT.

Red line (P, P) is peritoneum, of which Ms, Ms is mesosalpinx, layers of which are widely separated, while uterine tube (ET) is spread out flat on its surface.

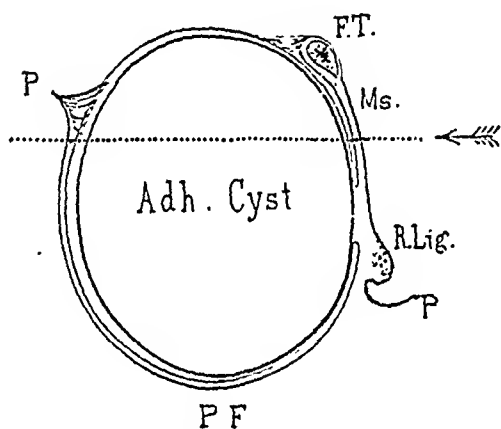


FIG. 633.—ADHERENT CYST OF OVARY; A MIMICRY OF INTRALIGAMENTARY CYST.

Uterine tube (ET), mesosalpinx (Ms), and pelvic peritoneum (P, PF, P) adherent to cyst on all sides. Dotted line and arrow indicate level of pelvic brim.

The structures concerned in the pedicle are the mesovarium, the utero-ovarian, and the infundibulopelvic ligaments, the mesosalpinx, the uterine tube, and the broad ligament, each deserving consideration as the treatment is simple or difficult according to the character of the pedicle and its component structures.

Occasionally the mesovarium is pulled up with the utero-ovarian ligament to form a pedicle 6 or 8 centimeters in length, Figure 631. Again, the tumor (usually parovarian) develops in the outer part of the mesosalpinx and the ampullar part of the uterine tube lies stretched on its surface, Figure 632.

In contrast to the tumors lying between the layers of the broad ligament without a pedicle, is the pseudoligamentary ovarian tumor, the size of a fist or a child's head, imprisoned in the pelvis beneath the tube and the mesosalpinx

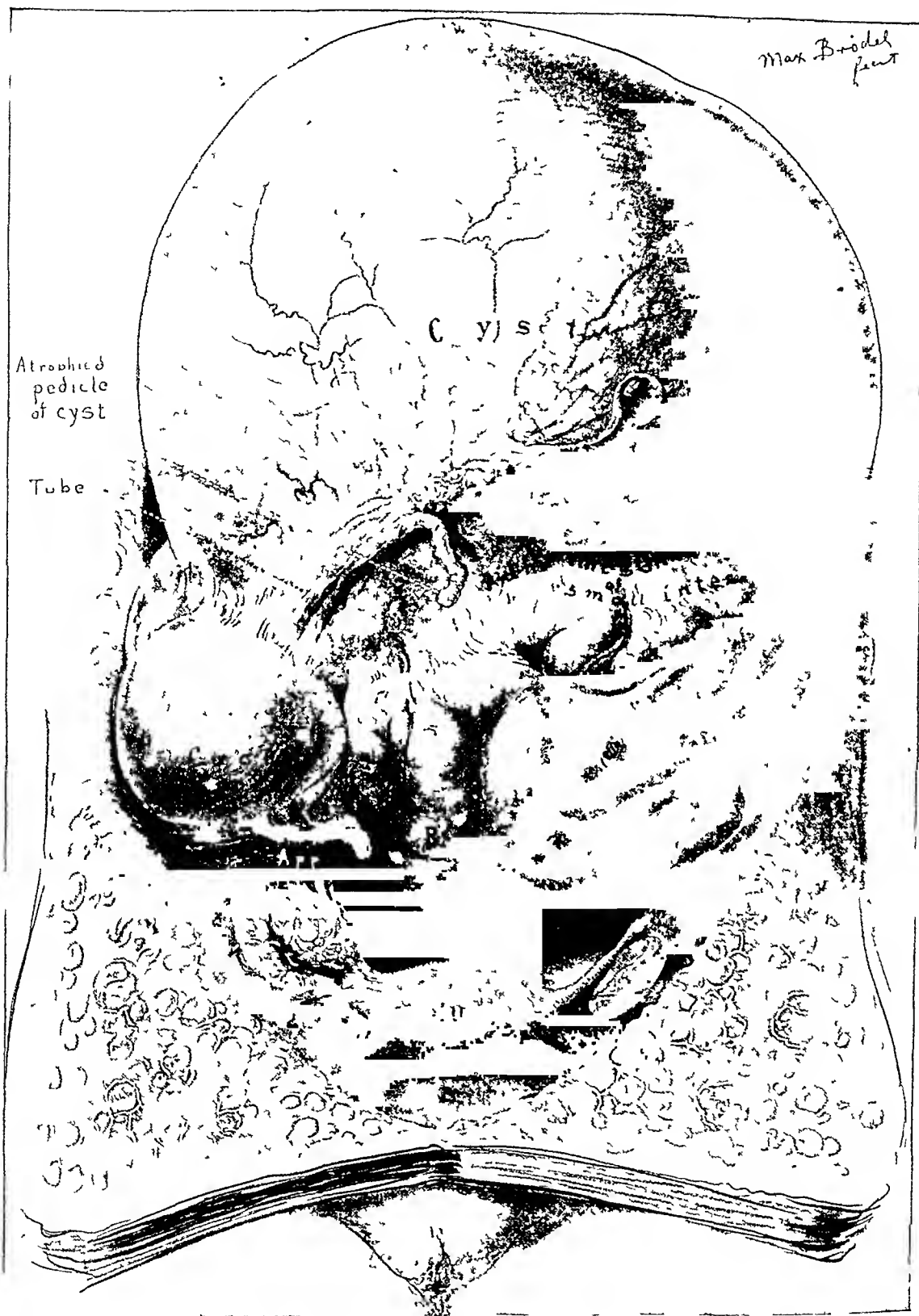


FIG. 634.—PARASITIC OVARIAN CYST OF LEFT SIDE WITH GENERAL PERITONEAL CARCINOSIS.

Cyst rolled upward, showing under surface and atrophied pedicle with uterine tube. In place of left tube and ovary in pelvis is seen detached uterine end of pedicle.

which it pushes up until the mesosalpinx covers it like a hood; a similar effect is due to broad ligament adhesions, covering in the tumor (Pawlik), Figure 633.

Long-pedicle, spherical, nonadherent cysts are peculiarly liable to rotation and strangulation, with a hemorrhage into the interior even large enough to cause death. If a woman survives, the entire blood supply may be cut off and gangrene ensue.

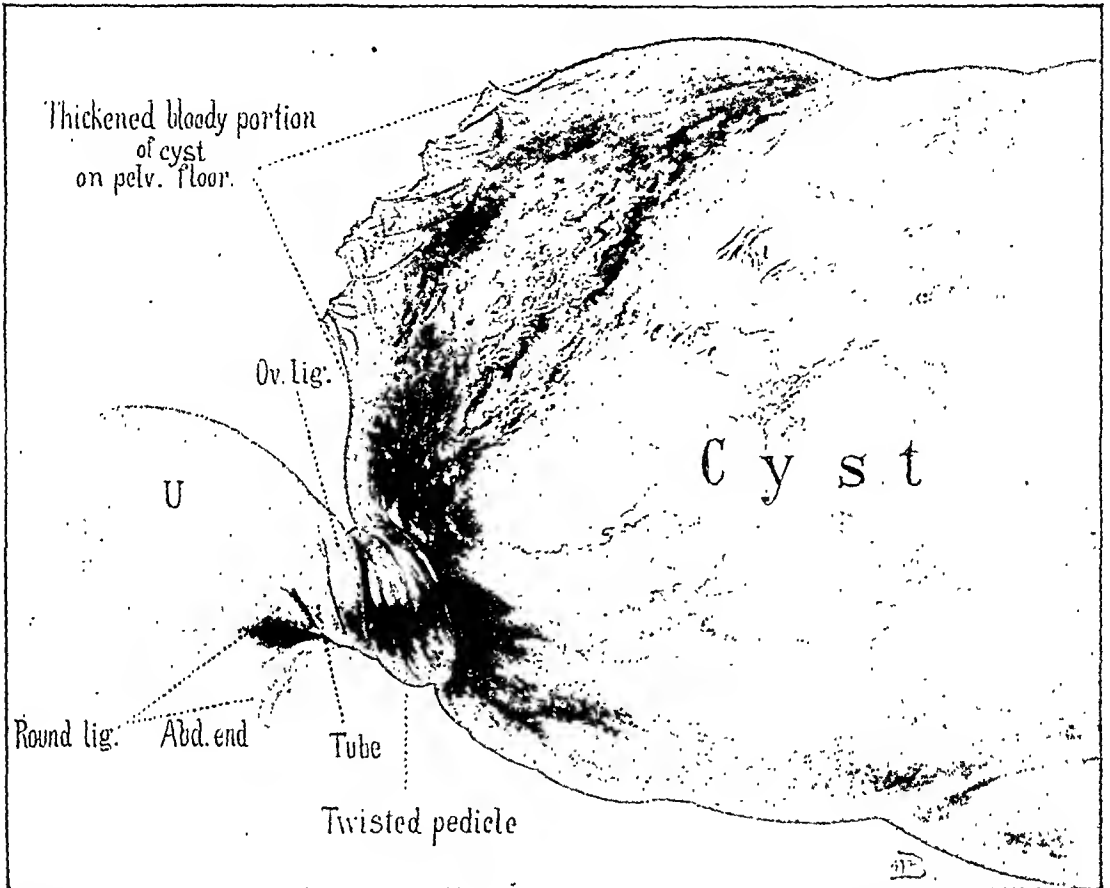


FIG. 635.—LEFT OVARIAN CYST WITH A TWISTED PEDICLE, INCLUDING UTERINE TUBE, OVARIAN LIGAMENT AND ROUND LIGAMENT.

Area of hemorrhagic infarct well shown in pedicle and adjacent cyst wall. $\times \frac{2}{3}$.

The symptoms of strangulation are sudden pain, pallor, and sometimes fainting, with sudden enlargement of the tumor which becomes tense and painful. The tumor of Plate X was from a woman over seventy, who was seized with sudden severe pain and nausea, with swelling and marked sensitiveness of the abdomen from a half twist in the pedicle and a hemorrhagic infarct, occupying two-thirds of the walls of the large cystic tumor.

If the patient survives the onset, she may then show a progressive weakness, be confined to bed, and develop peritonitis; later the cyst, originally free, is invested in adhesions. Suppuration may then supervene with chills and high temperature. Rarely, the pedicle atrophies, becomes detached, and the tumor

passes into a parasitic existence. In Figure 634 there were ascites and extensive carcinosis, and the cyst was simply aspirated to relieve pressure. Another, Figure 635, had hemorrhage adjacent to the twisted pedicle in the cyst walls. The twisted short pedicle occluded the uterine tube and, what is quite rare, the round ligament was caught in the twist.

O. Küstner (*Centralbl. f. Gynäk.*, 1891, No. 11) believes that right ovarian tumors usually rotate from left to right and left tumors from right to left. In four on the right side, he found the twist following his rule, and in six left-sided tumors, he noted it in five.

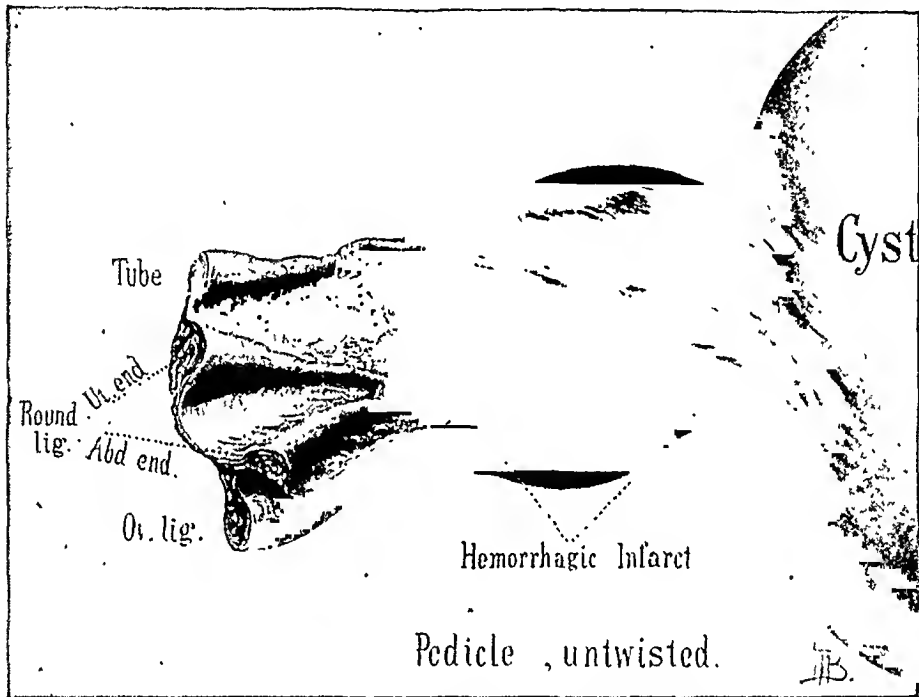


FIG. 636.—PEDICLE UNTWISTED TO SHOW ITS ANATOMICAL ELEMENTS, EXTENT TO WHICH ROUND LIGAMENT IS INVOLVED, AND HEMORRHAGIC INFARCT. $\times \frac{2}{3}$.

Cystic Rupture.—This occurs spontaneously or from a contusion as in falling downstairs or from a chair, accidents to which women with large tumors seem peculiarly liable.

If a large blood-vessel is torn, death ensues. If the cyst contents are bland, as in most parovarian cysts, they are rapidly absorbed and thrown off with a high degree of polyuria lasting for some days. An irritating fluid provokes peritonitis and adhesions, papillomata are disseminated, and ascites follows.

A rarer rupture is a pinched-out hole with tough pseudomucinous fluid oozing slowly out. In one, the hole was found plugged from within by a little flaccid cyst.

Treatment.—The proper treatment is extirpation as soon after the discovery of the tumor as the physical condition of the patient permits, the reason for

such promptitude lying in the impossibility of stating that the tumor is assuredly not malignant. Here truly a stitch in time saves nine, or rather saves the undertaker.

A salutary lesson was learned in this connection from a fine active young woman with a little ovarian tumor on the left, not as large as a lemon, who was so well and had such a horror of surgery that the pressing advice of friends not to mention tumor was followed, under the proviso that she remain under observation. She was next seen a year later, with the pelvis choked with papillomata and implantations on the peritoneum, only to die a few weeks later.

An apparently harmless cyst may rupture at any moment and disseminate the seeds of a carcinoma or papilloma over the peritoneum. By waiting, the further risk is incurred of a torsion of the pedicle and hemorrhage. With delay, also, inflammatory changes supervene, adhesions form, or the cyst suppurates, and an operation which might have been short and simple at first becomes protracted and embarrassed by complications. Other sequelæ of delay need not be listed.

The reasons inducing patients to seek relief were "a tumor" in forty-four cases, the increasing size of the abdomen in twenty-seven, pain in twelve, edema, dyspnea, and tachycardia in four, and exhaustion and weakness in one.

Age is not a valid reason for refusing an operation, for out of one hundred over seventy, in the hands of fifty-nine surgeons, many in the early evolutionary years of aseptic surgery, only twelve died. (H. A. Kelly and Mary Sherwood, "Ovariectomy in the Aged," *Johns Hopkins Hosp. Rep.*, 3.)

It is important to note that the number of malignant cases affecting the permanency of the result in this group was small. The classification was:

<i>Nature of Tumor</i>	<i>Number of Cases</i>
Multilocular	60
Unilocular	12
Parovarian	3
Dermoid	2
Tuberculous	1
Fibroma	2
Papilloma	3
Sarcoma	1
"Cyst"	7
"Tumor"	9
	<hr/>
	100

The results in eleven over eighty, as collected by Bland Sutton (*Surgical Diseases of Ovaries*, 1896), are remarkable; in the hands of ten operators, all recovered.

There are also cogent reasons for removing a tumor as soon as practicable in young children, where the growth is rapid, the space is small, the walls are tense, and the liability to malignancy (sarcoma) and rapid dissemination enormously enhanced. Out of one hundred fifteen years old and under, collected by Sutton, from many operators, there were forty-one simple cysts and adenomata with three deaths, thirty-eight dermoids with five deaths, and twenty-one sarcomata with seven deaths. There is a notable variation in the kinds of tumors in the two tables, sarcomata in children forming nearly 20 per cent as contrasted with one in the old; in the children, too, there is a relative increase in the dermoid tumors, thirty-eight in one hundred, while in the aged, the ratio is two to one hundred. The increased mortality in youth is due to sarcoma.

The good or ill condition of the patient naturally militates for or against the operation. Where she is much reduced or has any chronic disease of vital organs, the chances are lessened; mere increase of danger, however, ought never to prevent a conscientious operator from assuming necessary risks with proper discrimination. By assiduous attention, rest in bed, and regulation of the emunctories, a patient, whose vital resources seem at first depressed below the safety line, often improves and passes the ordeal. "Heart disease," speaking generally, is a serious disadvantage only in protracted, severe operations; a slight albuminuria with casts often clears up after ablation of the tumor.

An uncertain diagnosis, too, deters the surgeon. Doubtful cases should at least be given the benefit of an exploratory incision, when in some the disease will prove not to be an inoperable carcinoma or papilloma but tuberculosis; again, occasionally, a malignancy will be relieved unexpectedly by complete extirpation.

It is often well worth while, even when all the disease cannot be removed, to take out the mother tumor, relieving pressure and ascites. Occasional complete recoveries take place from a disseminated papilloma.

Tapping an ovarian cyst, so common in the hands of our honored sires, is scarcely justifiable nowadays. In rare instances a parovarian cyst has not refilled after tapping, but there is always the uncertainty of the presence of papillary elements within.

Where there is an enormous growth with wide spreading ribs and great dyspnea, it may in rare instances be well to tap and reduce the abdomen a few days before operation, to let respiration and circulation readjust themselves gradually.

Operation.—The aseptic technique is that common to all surgical operations. The steps follow:

1. Long median abdominal incision, exposing the tumor
2. Evacuation of cyst
3. Withdrawal, at the same time liberating adhesions

4. Ligation of the pedicle
5. Cleansing the peritoneum if it has been soiled
6. Closure of abdominal wound

The risks are the dissemination of the contents and hemorrhage from the ovarian vessels in the infundibulopelvic ligament which anastomose with the terminal uterine artery jept by a genial Chicago doctor the Byron Robinson circle.

There is a wise growing tendency to remove tumors up to the size of a uterus at term through a long incision, say from umbilicus to symphysis, to avoid the risk of peritoneal implantations.

It is advisable to divide the pedicle as far away as convenient from the tumor.

If the bladder extends high up, the opening into the peritoneum must be made up near the umbilicus.

In handling malignant growths, the first step on opening the abdomen is a careful survey of the entire field to determine whether or not a radical operation is advisable. If metastases are extensive and the removal of the tumor promises serious difficulties, it will be better to close at once after taking a little tissue for the microscope. If the tumor can be removed with comparative safety, it would seem better to take it out, and, sometimes, the better plan, when both sides are implicated, is to remove both ovaries and uterus in one piece down one side, across the cervix or vaginal vault, and up the other side, which only takes a few minutes.

A large, brainlike, soft sarcoma begins to bleed almost if one looks at it; it is best if the bleeding is alarming not to stop to deal with it directly but to plunge, as it were, through all obstructions and control the ovarian vessels near the pelvic brim and the uterine at the cornu, then one can proceed more deliberately and make the extirpation as complete as possible.

Surgical diathermy must be used to wipe out metastases or any suspicious tissue in the pedicle (Chapter XLVIII).

If there is likelihood of some slight continuous hemorrhage or serous weeping, it is better to drain with a gauze wick rolled in protective, preferably by the vagina.

A d h e s i o n s.—Methods of dealing with adhesions are described in Chapter XXII. I here detail only a few peculiarities connected with this group.

The adhesions to the abdominal wall, which sometimes cover the whole anterior parietes, must be detached with deliberate care to avoid dissecting off the peritoneum with the ovarian sac. Such a faulty dissection, begins by starting in the wrong plane of tissues and continuing until nearly the whole anterior parietal peritoneum is separated from its cellular base. Ordinary adhesions can usually be separated by pushing the hand with open fingers in between the sac wall and the peritoneum and opening and closing the fingers

with a shearing motion. A blunt dissector is also often handy. Any particularly dense adhesions are best dealt with by leaving a portion of the outer fibrous layer of the sac adhering to the abdominal wall. Omental adhesions, if extensive, are usually best treated by sacrificing as much of the omentum as may be necessary, even the entire omentum up to the colon.

In treating intestinal adhesions, always avoid opening the lumen of the bowel by cutting through the outer coat of the sac and leaving it adherent to

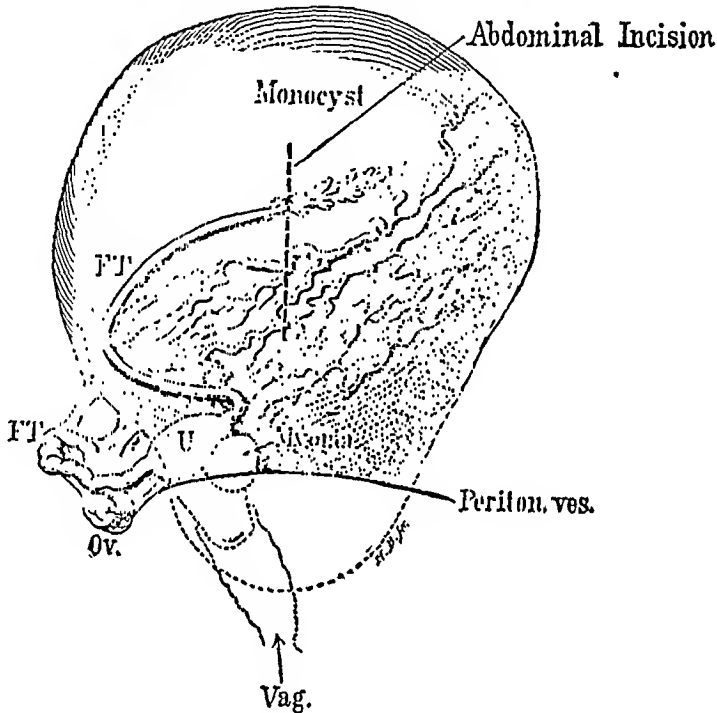


FIG. 637.—MONOCYSTIC TUMOR OF LEFT BROAD LIGAMENT.

Tube displaced and spread out on anterior surface of tumor; greatly dilated vessels of mesosalpinx below tube. Myoma in anterior uterine wall; adhesions to opposite tube and ovary. Dotted line shows part of tumor opposite abdominal incision. $\times \frac{1}{4}$.

the bowel—a principle applicable to adhesions small and large and most valuable in enucleating densely adherent suppurating ovarian cysts.

Such was the case in Figure 639, where a suppurating ovarian cyst filled the pelvis and lower abdomen and was universally adherent; the ileum from the ileocecal valve across to the left side was flattened out on top of the tumor, which adhered to its mesentery, as well as over the vertebral column and the great abdominal vessels. A complete detachment could not be effected here without resecting the ileum; the complication was met by leaving a cap of the outer fibrous coat of the tumor, covering this entire large area. The recovery was uneventful.

Ligating the Pedicle.—In ligating the pedicle, gauze is placed under and around it while it is held up, and two or more fine silk or catgut ligatures are passed through the "clear space" to include the vessels usually grouped at both borders. The ties should be placed well away from the tumor

to allow plenty of room to remove it without shaving it too closely. The utero-ovarian ligament calls for a fine separate ligature.

In a young woman it is not necessary to remove the uterine tube unless it is spread out over the surface of the tumor. It is a good plan to cut through the pedicle with the aeusector followed by desiccation of the raw surface to avoid leaving a raw surface, lessening the liability to postoperative adhesions.

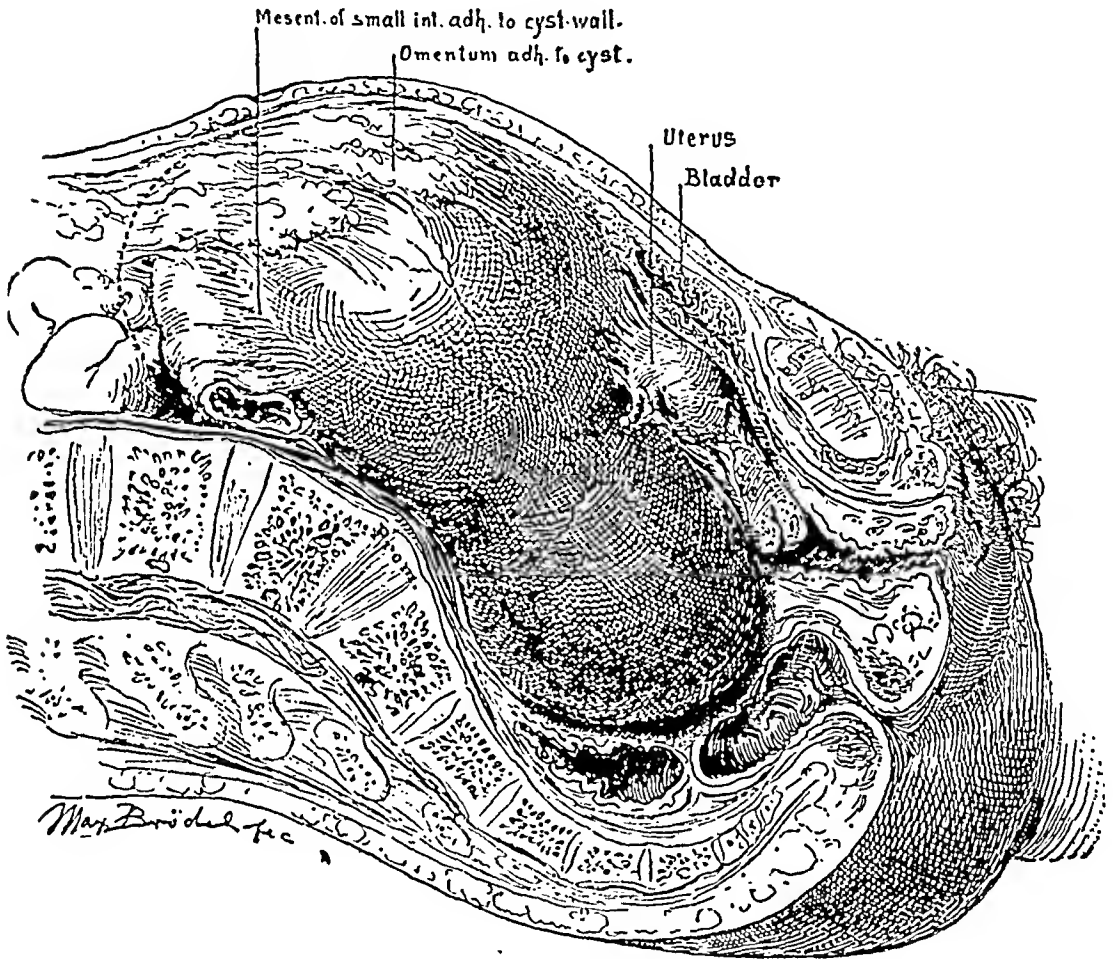


FIG. 638.—SUPPURATING ADHERENT OVARIAN CYST.

Showing extensive attachments to uterus, bladder, omentum, small intestine, and mesentery. Bladder and uterus pulled high up out of the pelvis by growth. See also Figure 639.

Intraligamentary Cysts.—When the ovarian tumor grows partly free into the abdominal cavity and partly down between the layers of the broad ligament, there is no real pedicle, but the separation may often be easily effected, after ligating the vessels on the side of the pelvic brim and on the uterine side, by splitting the peritoneum on a line at a level with the pelvic brim, and then simply drawing or shelling the tumor out of the loose areolar attachments which still hold it in the pelvis. These investing tissues are, as a rule, not vascular, the ligatures may be generally dispensed with. The top of the

broad ligament is then closed by a continuous catgut suture. If the tumor is large and unwieldy, evacuation helps greatly, while small tumors are easier to handle intact.

When the entire mass lies beneath the peritoneum, enucleation becomes harder, and difficulties increase in direct ratio with its size.

On opening the abdomen with a large retroperitoneal tumor, the posterior and visceral layers of the peritoneum may be found in contact with the anterior wall, with the pelvic peritoneum lifted up, rectum displaced, and sigmoid or colon pushed far forward. The ureter must be remembered and located early,

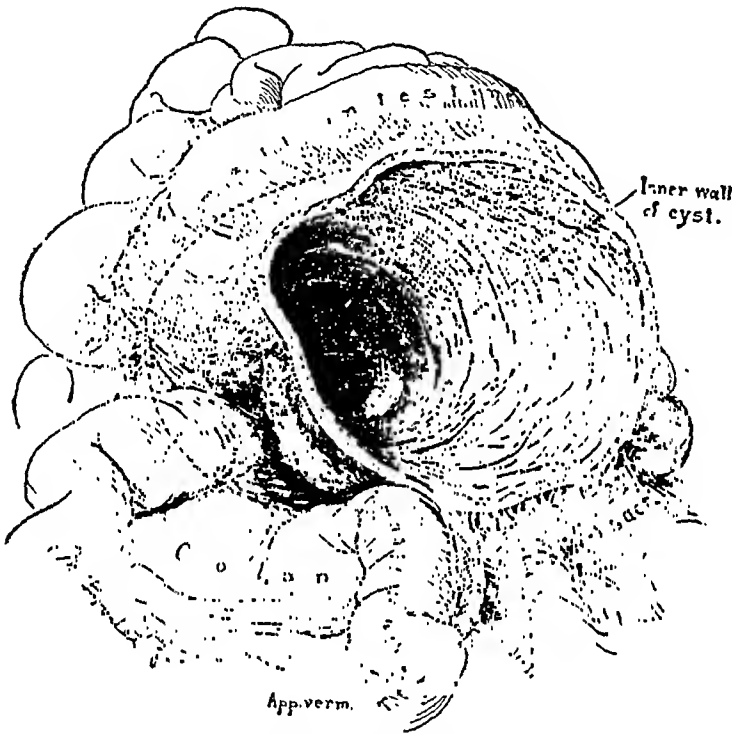


FIG. 639.—SUPPURATING ADHERENT OVARIAN CYST.

Relations of part of cyst wall intimately attached to small intestine and mesentery.

usually at or above the pelvic brim, and then traced in its relation to the tumor and kept constantly in view during the enucleation. Evacuation is a great help although the dangers of soiling and seeding cannot be overlooked. If the ureter is divided it can be closed at once by delicate suturing with a very fine needle and finest silk. It is better to cut it obliquely when it will be less likely to form a stricture. The most important tissue in the closure is the rather loose investing fibrous web in which it lies.

An intraligamentary tumor in one broad ligament crowds the uterus to the opposite side; intraligamentary tumors on both sides push it into the front part of the pelvis.

When both sides are affected, it is usually best, if the adhesions are bad, to remove uterus and tumors together either by ligating the ovarian vessels on

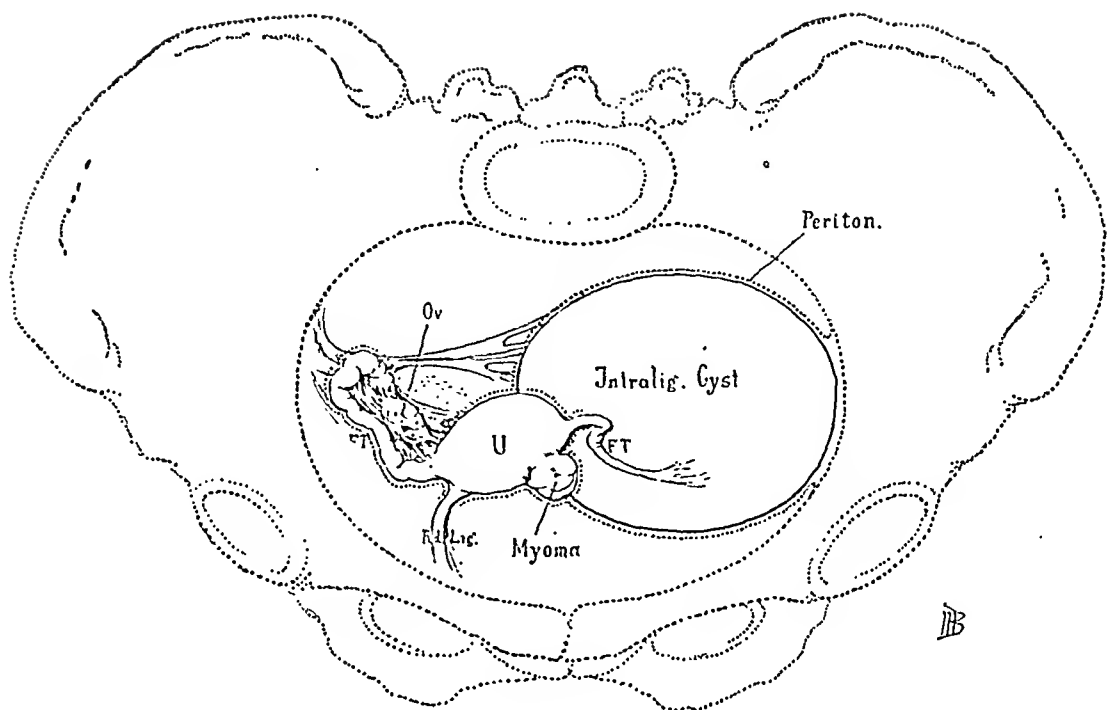


FIG. 640.—DIAGRAM FROM A CASE OF INTRALIGAMENTARY CYST, SEEN FROM ABOVE.

Relations of separated peritoneal layers of left broad ligament to cyst, and uterine tube (F T) spread out on surface. Right ovary and tube adherent and tube attached to cyst.

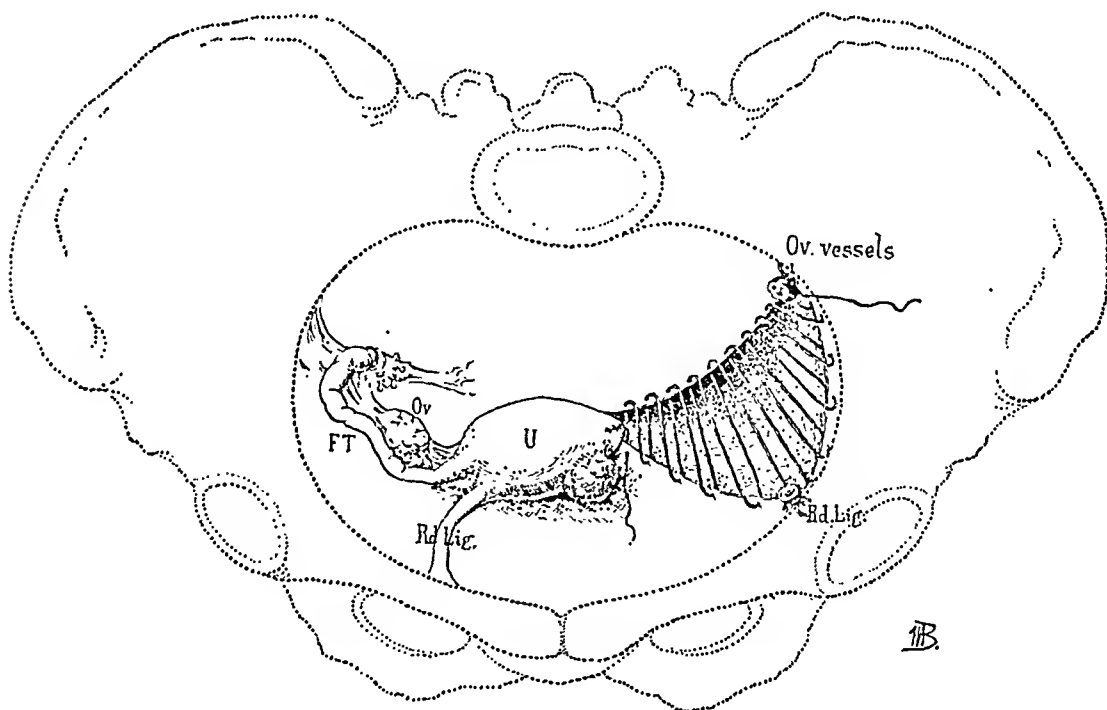


FIG. 641.—DIAGRAM SHOWING MANNER OF CLOSING UP DEFICIT LEFT IN ENUCLEATION OF AN INTRALIGAMENTARY CYST BY A CONTINUOUS CATGUT SUTURE FROM PELVIC WALL TO UTERINE CORNU.

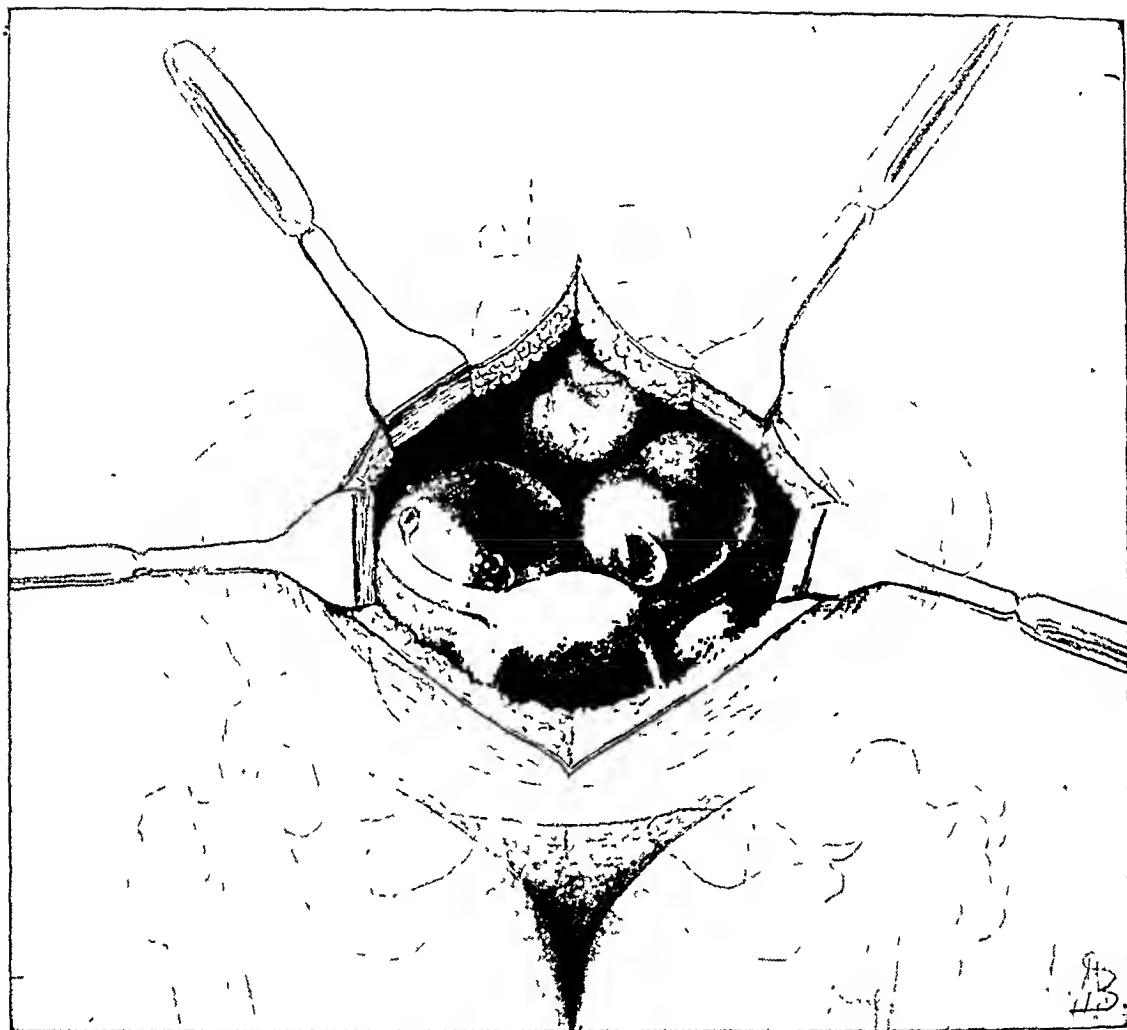


FIG. 642.—INTRALIGAMENTARY GRAAFIAN FOLLICLE CYSTS, *IN SITU*.
(See Fig. 643.)

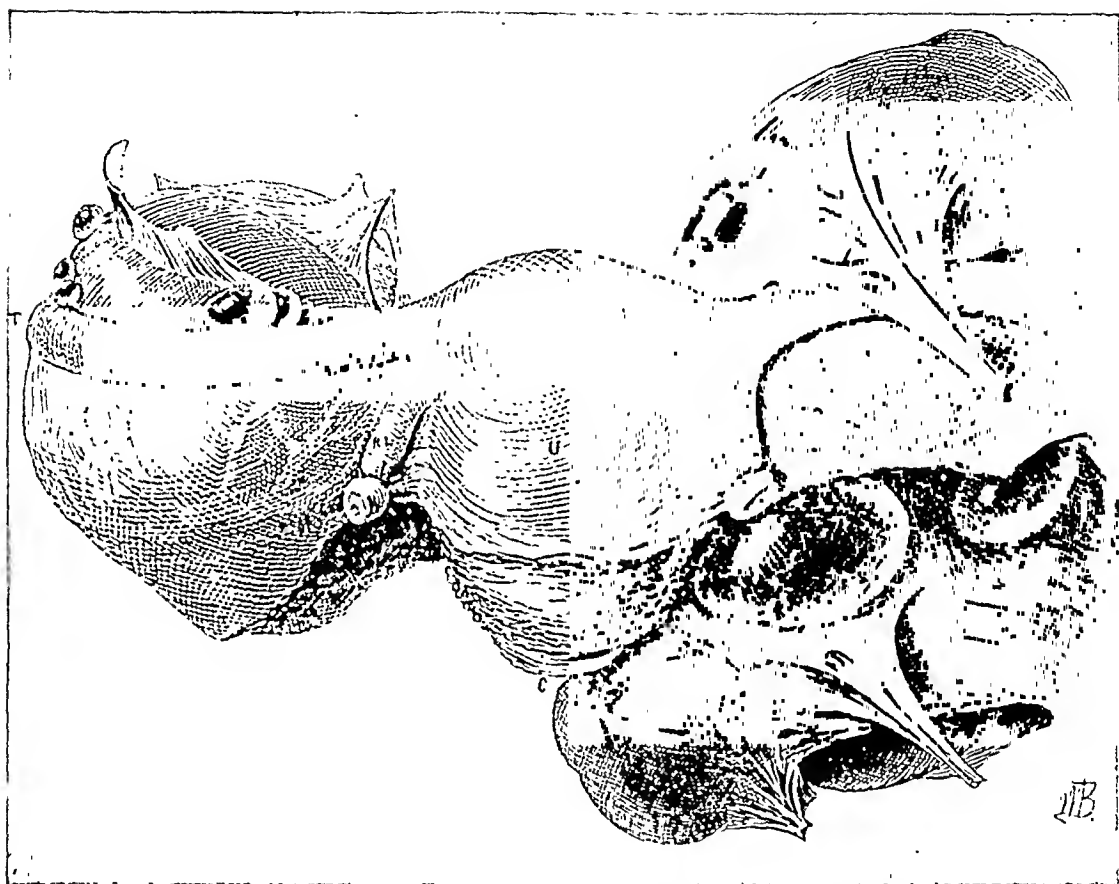


FIG. 643.—INTRALIGAMENTARY GRAAFIAN FOLLICLE CYSTS.
A mass best removed after bisection of uterus.

one side and so opening up the broad ligament and peeling out and rolling one of the tumors with the uterus up and out of the incision, controlling the uterine vessels on that side, amputating the uterus in its cervical portion, securing the uterine vessels of the opposite side, and, finally, easily shelling out the second tumor from below upward, clamping the ovarian vessels as in a hysteromyomeetomy, or, better still, by grasping the uterus at the right and left cornua with stout museau forceps, pulling it strongly up, and bisecting it

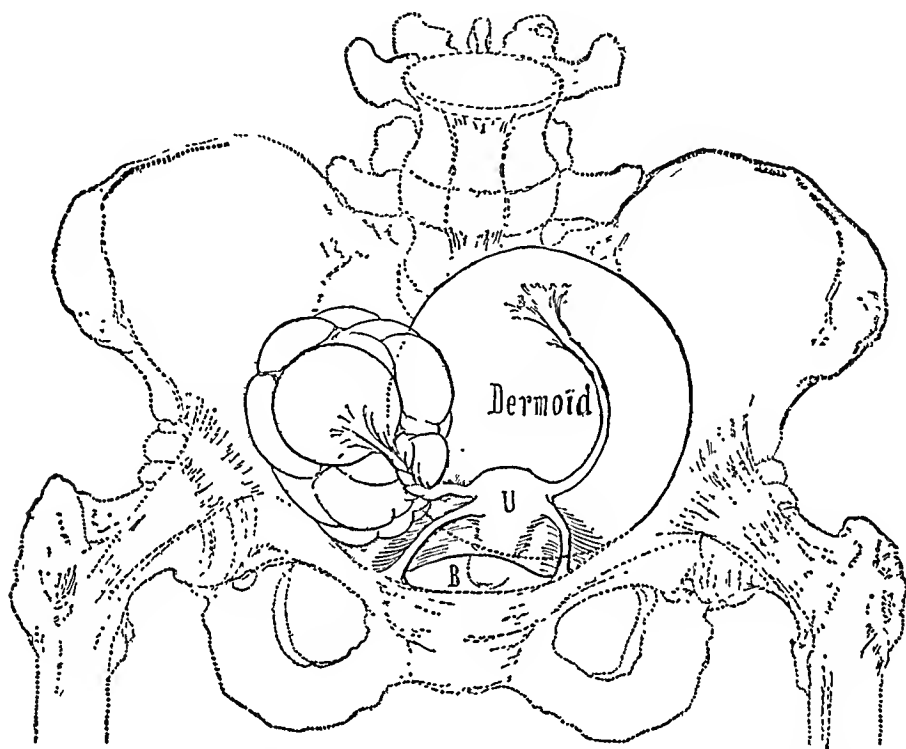


FIG. 644.—LEFT DERMOID CYST AND RIGHT MULTILOCULAR OVARIAN CYST WITH TWISTED PEDICLE.
Elevation of uterus.

down into the cervical region when each half is removed separately with its lateral burden as described in Chapter XXIV.

In removing a unilateral intraligamentary tumor, bear in mind that its blood supply comes from the identical channels from which it sprang while the tumor was small—from the ovarian and terminal branches of the uterines; if, therefore, these are patiently sought and secured at once, there need be but little hemorrhage throughout the operation.

Complicated Cases.—In cases complicated by disease of both ovaries, as in the case of multiple dermoids, Figure 539, or where a dermoid of one side complicated an ovarian cyst of the other, Figure 644, or where there is an extensive fibroid degeneration of the uterus, Figure 645, associated with a fibroid ovary, it is better to do a hysterectomy with ovariectomy, removing the uterus, tubes, and ovaries in one mass as described. In ovarian papillary

tumors, the one safe plan is the removal of tubes and ovaries and uterus as in Figure 646. The patient will often be benefited even though the whole disease cannot be extirpated. After the operation, ascites will return less rapidly.

Opposite Ovary.—The opposite ovary, if left, ought always to be inspected and a careful note of its condition entered in the history. If it is evidently diseased, it should always be removed also; in a young woman, con-



FIG. 645.—FIBROMA OF LEFT OVARY (MO), WITH LARGE MYOMATA (M, M) OF UTERUS (U).

Note smooth surface and coarse exaggeration of form of ovary, large vessels, and dense band of adhesion (P') stretching down under its hilum, attaching it to broad ligament. $\times \frac{1}{3}$.

servatism where safe should be the ruling principle, and a tube or a sound piece of ovary retained, even if it be but one tube and the opposite ovary. Resection of the ovary may sometimes be practiced in dermoid cysts and in an ovarian cystoma like that in Figure 595, if the patient is a young woman, and it is necessary to remove the opposite ovary, provided the patient consents to remain under observation.

This question was much discussed two generations ago before operators realized the effect of a total ablation upon a young woman. Back in the eighties, I counted over one thousand ovariectomies and selected those done in young women. My memory is that in thirteen, in which the second ovary was

left and recurrence took place, one died from the operation, while to all the women with a single ovary upwards of fifty children were born.

A drain should be left either in the lower angle of the wound or in the vagina whenever there are any extensive raw surfaces left which are likely to ooze. This will insure a much more comfortable convalescence.

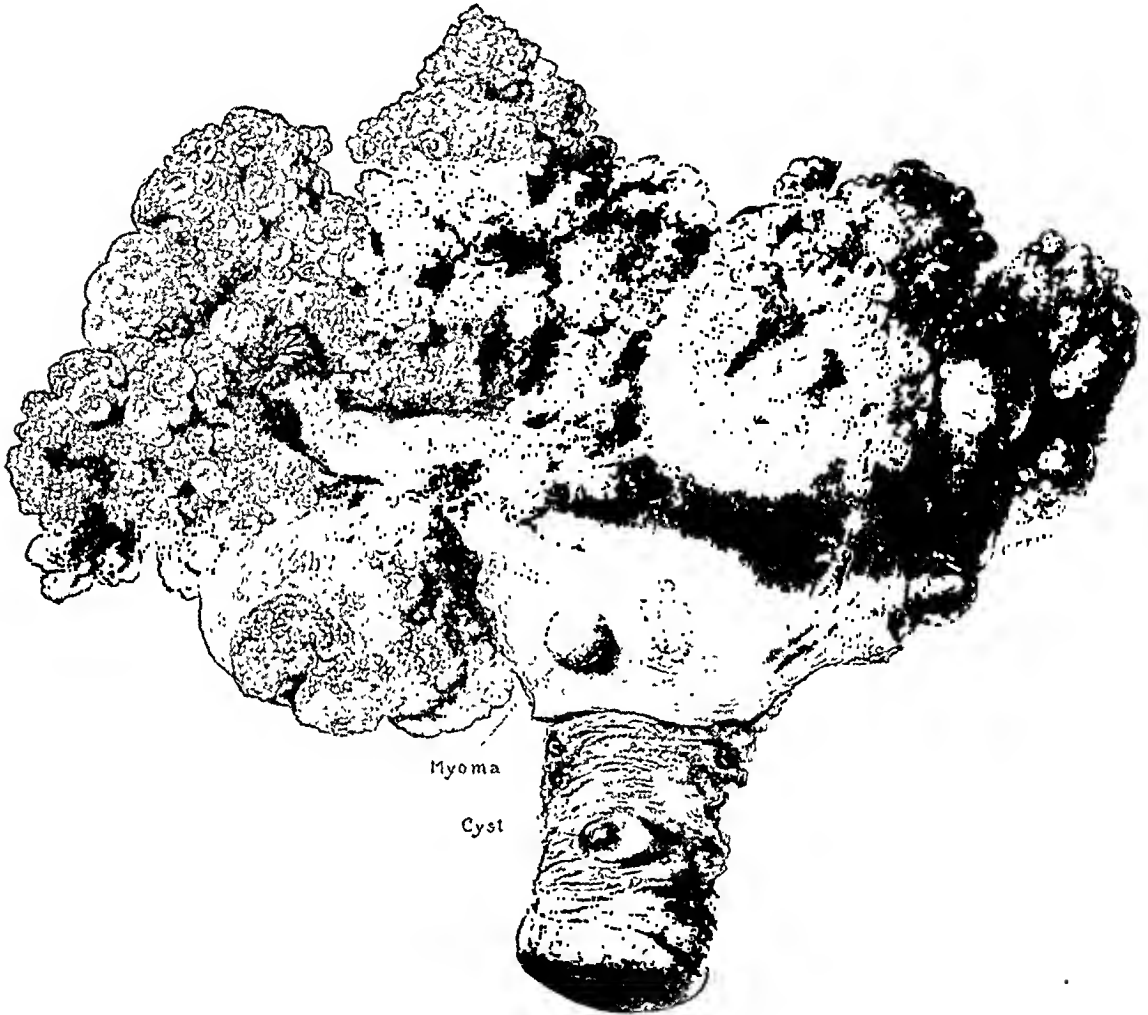


FIG. 646.—PAPILLARY CYST OF BOTH OVARIES WITH METASTASES TO OMENTUM, ABDOMINAL WALLS, ETC.

* Extensive enucleation of ovaries, tubes, and uterus. Recovery. Death from recurrence a few months later.

Radium and X-Ray.—Radium and x-ray treatments have not replaced surgery when operation is possible or when all of the tumor growth can be removed. However, they have served as invaluable aids in caring for cases of recurrent tumor and in those not completely removed at operation. This is completely discussed in Chapters XLIV and XLV, devoted to special types of treatment.

CHAPTER XXXVIII

TUMORS OF THE FALLOPIAN TUBES

HOWARD A. KELLY

POLYPS

PAPILLOMA

PAPILLARY CARCINOMA

FIBROMA

SARCOMA

CHORIO-EPITHELIOMA

TUMORS OF THE FIMBRIATE EXTREMITY

Tumors of the uterine tubes, rare as compared with the new growths of the uterus and of the ovaries, began to attract particular attention in the late eighties following the reports of cases by A. Doran, E. G. Orthmann, Bland Sutton, T. Wyder, and J. Doleris. An important stimulus was given this subject by M. Sänger and J. Barth in A. Martin's monograph, *Die Krankheiten der Eileiter* (Leipzig, 1895). A résumé in part is that of E. R. Le Count, "The Genesis of the Fallopian Tube in Hyperplastic Salpingitis" (*Johns Hopkins Hosp. Bull.*, 1901, 12).

The component structures of the tubes give rise to the following tumors:

Polyps

Papilloma

Papillary carcinoma

Fibroma

Sarcoma

Chorio-epithelioma

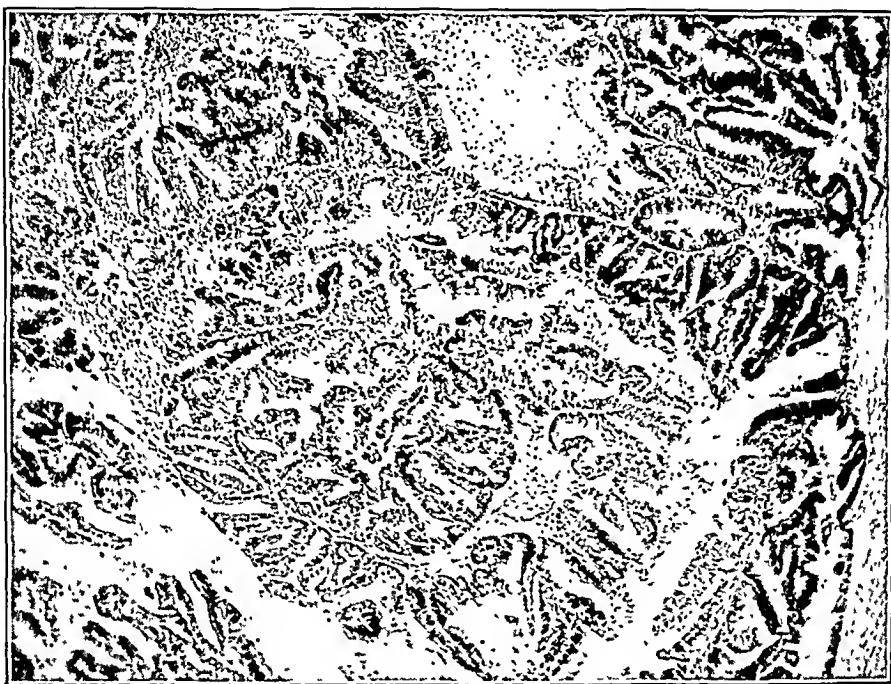
Tumors of the fimbriate extremity

Polyps are rare and small, and touching many of those described, the question may well be raised whether they are true polyps in the sense of a spontaneous localized outgrowth of a superabundant mucosa. The reports register rather the products of a chronic inflammatory reaction of the tube, more deserving of the name pseudopolyps. Wyder (*Arch. f. Gynæk.*, 1886, Bd. 28) describes two polypoid excrescences in the intra-uterine part of the tube, one of which was 8 by 3 millimeters.

Papilloma.—Two new growths, papilloma and papillary carcinoma, are with difficulty separable clinically, except in the more advanced stages of the latter. The papillomatous tumor forms a more or less cauliflower growth, springing from well-defined areas of the tubal mucosa, usually on one side,

sometimes bilateral, never invading the deeper tissues although sometimes with small peritoneal implantations. According to A. Martin, such a papilloma never springs from a healthy mucosa and is the product of a chronic salpingitis and sactosalpinx, when the abdominal end of the tube is as usual closed. An open tube discharges a serous accumulation into the perineum and may give rise to an extensive ascites and even to hydrothorax (Doran's case, 1888). The treatment is the radical extirpation of one or both tubes.

The cystic tumor, 12 by 12 centimeters, was an enlarged distal part of a fallopian tube covered on the inside with a thick papillary growth made up of



1

FIG. 647.—CARCINOMA OF FALLOPIAN TUBE.

1. Intact wall of tube surrounding wild papillary tumor growth. Under high power mitoses frequently found in columnar epithelium. $\times 40$.

multiple fungous excrescences massed in places in dense clumps, typically like cauliflower, the branches containing small cysts; cystic spaces were also formed by the fusion of the papillomata in a manner analogous to cystitis cystica. The tubal wall was greatly thinned. The epithelium was in general in one layer and in no place tended to invade the underlying tissues. The early history served to confirm Doran's opinion that such papillomata are the result of an antecedent chronic inflammatory disease, parts of the disease appearing as a simple hyperplasia while elsewhere there is a great increase in the connective tissue with epithelial proliferation.

Papillary carcinoma may be grafted on to the simple form or may arise independently to form a loose, vegetating, soft, often granular mass or as a massive firm bunch of fibrous tissue, more or less cystic and invasive of the

tubal wall with metastases in the direction of uterus or ovary or into the regional glands. Such tumors are either *de novo* in local products or secondary to adenocarcinoma of the uterus which, as noted in the earliest reports, they remarkably resemble, or they appear to be secondary to an ovarian growth. The glandular appearance so closely resembles the uterine growths (C. Ruge, *Ztschr. f. Geburtsh. u. Gynäk.*, 1895, 31) that earnest efforts were made very early by Bland Sutton and others to solve the puzzle by discovering glands or something analogous to uterine glands in the tube, either in the field of comparative anatomy or the development period. Just here, the discovery of

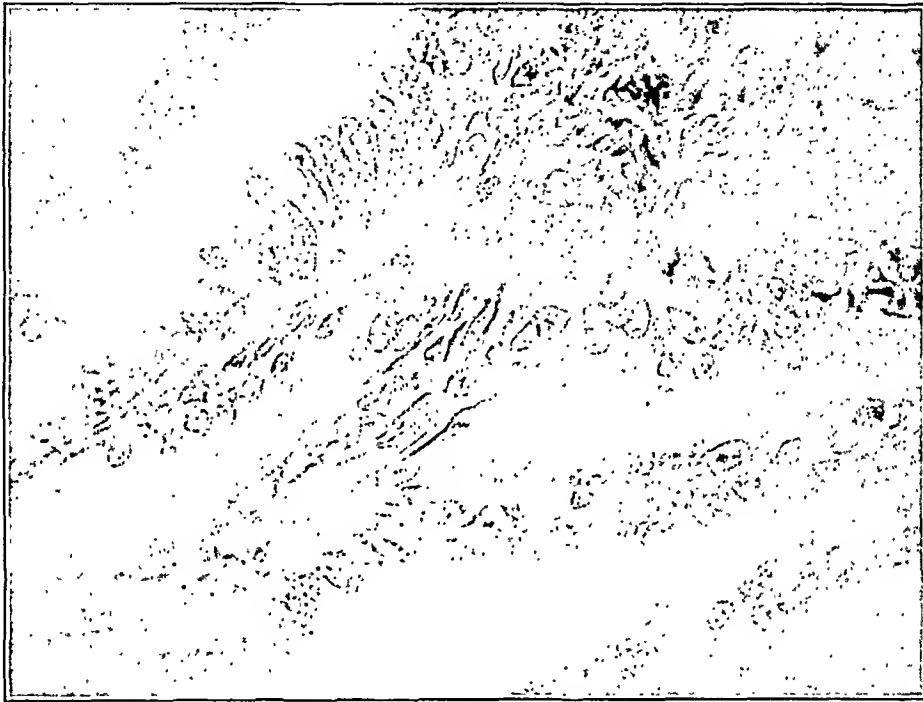


FIG. 648.—CARCINOMA OF FALLOPIAN TUBE.

Same as Figure 647. Showing frequent mitoses in columnar epithelium. $\times 440$.

endometrial implants by Sampson deserves especial attention (Chapter XXXIX). A free watery discharge *per vaginam* with a tumor lateral to the uterus should give rise to the suspicion of a papilloma or papillary carcinoma and not be watched as a simpler profuse dropsy of a tube. There should be radical extirpation of both tubes and uterus, including ovaries if there is any evidence of involvement, with the destruction so far as possible of more distant and inaccessible foci with the high frequency current (Chapter XLVIII).

E. Hurdon reports an instance (*Johns Hopkins Hosp. Bull.*, 1901, 12), a woman of sixty-three who had an irregular softish mass the size of a mandarin orange to the left of the uterus. The uterus, right tube, and left tubo-ovarian mass were removed and the patient recovered uneventfully.

The tumor consisted of finely branched papillary outgrowths to a great

extent coalesced and forming a more homogeneous mass. The fimbriated end was replaced by the neoplasm and a papillary excrescence projected into a small cyst cavity in the ovary. The stroma was a vascular connective tissue covered with several layers of epithelium coalescing in places and forming gland-like spaces. The nuclei of cuboid or flattened cells showed numerous mitoses and irregular forms. In places the growth extended into the muscular coat for a short distance with leukocytic infiltration. The advancing margin of the disease showed considerable leukocytic infiltration and was generally bounded by a zone of round cells. In its finer structure, it resembled a carcinoma of the uterine body. The uterus was normal. A year later, another operation was done for a persistent lower abdominal discomfort and a mass the size of an olive removed from the base of the left broad ligament as well as a bean-sized nodule from the surface of the bladder. Minute infiltrating deposits were left *in situ*. These growths were identical with the parent structure. A year later, she was still in good health.

T. S. Cullen (*Johns Hopkins Hosp. Bull.*, 1920, 22) reports a woman of forty-six who had had an attack of peritonitis two years previous. She had suffered severe pain in the right iliac fossa for over a year; both legs were swollen. Lateral masses with a small uterus were removed by bisection (H. A. Kelly) with a bit of intestine and a small subperitoneal cyst. The growth was a carcinoma characterized by a marked tendency toward gland formation and papillary outgrowths. Nearly three and a half years later there was an evident recurrence without any marked effect on the general health.

Fibroma is rare. H. Fehling describes one as large as a uterus at term.

Kelly and Cullen (*Myomata of the Uterus*, Fig. 23) describe a little pedunculate myoma, 7 by 8 by 10 millimeters, on the upper surface of the right tube. Cuthbert Lockyer (*Fibroids and Allied Tumors*) notes one with two myomatous nodules on the right tube, respectively 2 and 1 centimeters in diameter, one an adenomyoma, and cites M. Auvray (*Arch. mens. d'obstet. et de gynéc.*, 1912, 1) who collected twenty-nine cases, some doubtful. One weighing 2,800 grams was attached to the outer extremity of a malformed tube blind at its uterine end, while the central portion was represented by a large hydrosalpinx.

Sarcoma of the mucosa of both tubes, a rare affection, is described by C. von Kahlden (*Ziegler's Beiträge*, 1897, Bd. 21).

Chorio-epithelioma occurs after tubal pregnancy (Risel, *Ztschr. f. Geburtsh. u. Gynäk.*, 1905, Bd. 56).

Tumors of the fimbriate extremity are found here and there scattered through the literature. A striking case is that of a cystic fibromyxoma of the fimbriæ, figured in color in Martin's book (*ut supra*, Plate V).

The practical lesson taught by these neoplasms is that a doubtful mass lateral to the uterus, after due investigation and study, calls for exploration.

CHAPTER XXXIX

ENDOMETRIOMATA

INCLUDING ENDOMETRIAL HEMATOMATA OF THE OVARY

ROBERT M. LEWIS

SYMPTOMATOLOGY

ETIOLOGY AND PATHOLOGY

TREATMENT OF BENIGN ECTOPIC ENDOMETRIOMATA

MALIGNANT IMPLANTS OF ENDOMETRIAL TYPE

The term *endometriomata* is used to indicate certain lesions characterized histologically by their content of epithelium resembling uterine or tubal mucosa, some of which respond physiologically to the stimulus of menstruation and to the changes of pregnancy. Occasionally, their glandular structures have become necrotic or disappeared as a result of pressure atrophy. Such tumors have been found in the uterine wall, particularly in the neighborhood of the cornua, in the tubes, ovaries, and round ligaments (intra- and extra-peritoneal portions); also, in or on the pelvic peritoneum, appendix, large and small bowel, in the rectovaginal septum, and in the abdominal wall.

Large hemorrhagic or chocolate cysts of the ovary have been a recognized clinical entity for many years. They are usually found in women between thirty and fifty years of age, are frequently bilateral, and their recognition, previous to operation, is often attended with some difficulty.

Before J. A. Sampson's brilliant contribution in 1921 (*Arch. Surg.*, 3:245-323), various hypotheses accounting for the etiology of adenomyomata were current. As long ago as 1899, W. W. Russell described the presence of tissue resembling endometrium in a cystic adenocarcinoma of the ovary, attributing its histogenesis to the development of a misplaced portion of the müllerian duct. Since, Cullen, Casler, and others have reported like discoveries. The theory of the development of endometriosis by direct extension from the endometrium, or the possibility of an origin from germinal epithelium, wolffian or müllerian rests, as well as from peritoneal epithelium, was generally accepted.

Symptomatology.—Extensive bilateral chocolate cysts of the ovary may cause a period of sterility. Often the striking feature in the history of a patient with this condition is that of a severe acquired dysmenorrhea which may be associated with acute attacks of pelvic pain, possibly caused by a rupture of the cyst, with symptoms of a localized pelvic peritonitis. Frequently the condition is associated with fibromyomata or other pelvic disorders, making a

diagnosis by pelvic examination problematic. Such a history, with the finding of an adherent uterus with inflammatorylike masses in the region of the adnexa and a nodular infiltration or scarlike formation in the culdesac, indicates a probability of hemorrhagic ovarian cysts.

At operation, one or both ovaries may be found greatly enlarged and cystic, the cysts containing the typical grumous, syrupy material, while the extensive firm adhesions involving adjacent structures often make extirpation most difficult.

Etiology and Pathology.—Sampson's *Perforating Hemorrhagic (Chocolate) Cysts of the Ovary* shed a new light on the etiology as well as the treatment of a group of pelvic disorders. During the preceding year, he had found perforating hemorrhagic cysts of the ovary in fourteen of 178 patients between thirty and fifty years of age, operated upon for pelvic lesions. As a rule, the cysts were 2 to 4 centimeters in diameter and were bilateral in eight of twenty-three cases studied.

Adhesions, at times resulting from the ruptured ovarian cysts with the discharge of their contents, were commonly found and occasionally, when present in the culdesac, were so dense as to suggest malignancy. Sometimes "adhesions" were noted when no ovarian hematomata were discoverable. A histologic study of these cysts revealed varied findings in the several specimens and in different portions of the same specimen. It, therefore, seemed likely that what appeared to be varieties of cysts merely represented phases in the life cycle or corresponded to the several periods in the menstrual cycle.

One group of perforating hemorrhagic ovarian cysts revealed a portion of the hematoma lined by a membrane of phagocytic cells. The rest of the cysts appeared to be undergoing relining by an invasion from the epithelium on the periphery of the ovary through the perforation. The epithelial regeneration was of the endometrial type, both in structure and function. Eventually an entire cyst might be relined with epithelium. Sampson suggested that this group represented either the development of an endometrial cyst from the invasion of a follicular hematoma by misplaced "endometrial" epithelium or the regeneration of an "endometrial" cyst after a hemorrhage (*i.e.*, menstrual). The variations in the lining membranes admit of various interrelations.

Other types of cysts represent earlier or later stages of development of those just described and show a variable epithelial lining with a stroma not unlike the endometrium. At times structures like uterine glands were found in the stroma.

Sampson observed that precisely similar linings to those he found in ovarian hematomata exist in the uterine, occasionally seen in adenomyomata of the uterus and obviously due to retention of menstrual blood. In studying adhesions adjacent to the cysts, the astonishing discovery was made that adenoma of endometrial type was frequently present (in thirteen out of fourteen cases).

He concluded that at times in the life (or menstrual) cycle of the ovarian hematoma, rupture may occur with a discharge of blood and epithelial tissue into the peritoneal cavity, causing adhesions. Secondary adenomata of endometrial type then often develop, which may or may not be invasive. If invasive, they may cause "adenomyoma" of the uterus by invasion of the uterine

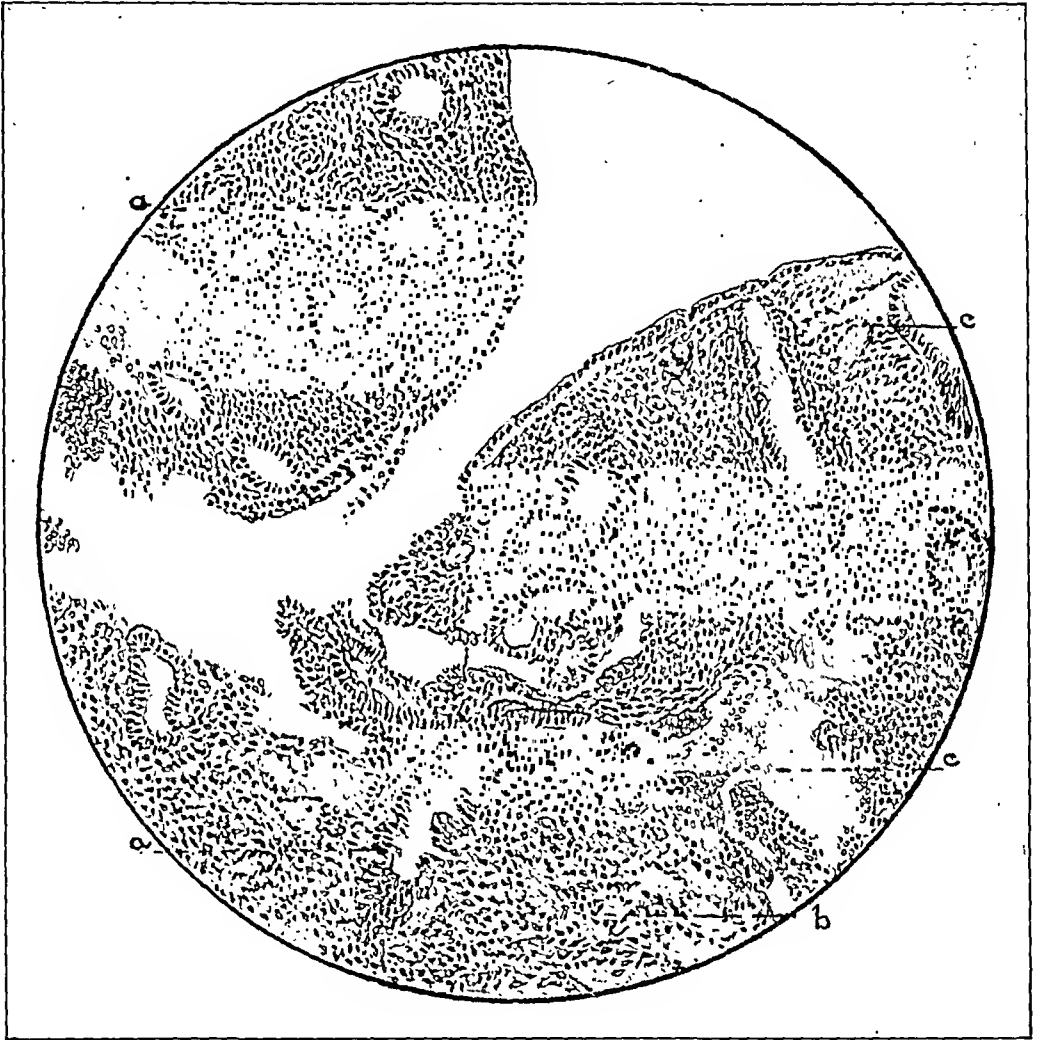


FIG. 649.—WALL OF OVARIAN CYST 1 CENTIMETER IN DIAMETER.

- a. Typical endometrial glands
- b. Endometrial stroma
- c. Interstitial hemorrhage

Patient, 36 years of age, complained of intense abdominal pain, most severe during menstruation. Single blood-filled cyst found in left ovary.

wall from without, or "adenomyoma" of the uterosacral ligament, round ligament, rectovaginal septum, rectum, sigmoid, umbilicus, and elsewhere, in whatever structure or organ becomes invaded by the adenoma from the "infective" contents of the cyst or ovary lodged on its peritoneal surface. The implantation and development of such adenomata are comparable to the similar process

in a ruptured ovarian tumor with the implantation of papilloma or cancer on the peritoneal surfaces.

Later studies point to the likelihood of a direct implantation of the endometrium expressed from the tubes on to the peritoneal surfaces without the intermediate action of the ovary as host.

As evidence that perforating cysts of the ovary are hematmata of the endometrial type, Sampson noted their "activity" during the menstrual life.



FIG. 650.—LOW POWER PHOTOMICROGRAPH OF WALL OF FALLOPIAN TUBE.

- a. Normal lumen
- b. Ectopic endometrial tissue

Patient, 46 years old, complained of increasing persistent abdominal pain. Endometrial tissue found in wall of fallopian tube (above) and in wall of rectum. She had had two normal pregnancies, one fifteen, the other seventeen years previous (Yale Woman's Clinic.) $\times 15$.

Histologically the lining epithelium of an ovarian hematoma is very like the uterine hematoma associated with adenomyoma of the uterus.

The chocolate content of the ovarian hematoma resembles old menstrual blood, and the appearance of the endometrial content of the cysts corresponds to that of the uterine endometrium at different stages of the menstrual cycle.

Sampson's subsequent contributions on the etiology and development of ovarian hematmata and the implantation adenomata of an endometrial type are convincing and of intense interest. Primary adenomyoma of the uterus or tube he recognizes as derived from a direct invasion of the uterine or tubal walls by the mucosa lining their cavities. Secondary (implantation) adeno-

mata he considers much commoner than the former type and most usual of all pelvic lesions found between the age of thirty and the menopause, with the exception of myomata. As an example of its frequency: He found it in fifty-two instances in a series of 198 gynecological operations on women between thirty and fifty.

Evidence was soon at hand to suggest that the endometriumlike tissues found in the ovary or in different peritoneal areas were really implants growing from bits of desquamated mucosa detached from the inner surface of the tube or uterus and washed out of the fimbriated extremity on to the ovary or pelvic peritoneum. Such a transplantation may occur during menstruation as a result of irregular uterine contractions or from an obstruction to the normal discharge through the cervical canal, or from other causes such as uterine manipulation, curettage, and so forth. In support of this view, Sampson notes that hematomata of the ovary are usually found during menstrual life, after thirty years of age. In his fifty-six cases with hematomata, the tubes were patent, making this avenue possible.

At operation, especially if the patient is menstruating, blood may occasionally be seen escaping from the tubal ampulla, which may contain particles of uterine epithelium. Occasional sections of tubes removed at operation have shown bits of endometrium, both epithelium and stroma, free in their lumina, evidently a backwash from the uterine cavity.



FIG. 651.—MICROPHOTOGRAPH OF ENDOMETRIUM IN LUMEN OF TUBE.

Hysterectomy with bilateral salpingo-oophorectomy performed on patient in Yale Woman's Clinic for chronic bilateral salpingo-oophoritis. Cross section of right fallopian tube shows microscopic evidence of chronic salpingitis. In lumen of tube, unattached to mucosa, is large piece of endometrium. Smaller piece of endometrial tissue also found free in lumen of left tube.

Ovarian hematomata and pelvic adenomyomata are often found in patients with some uterine condition which might interfere with the escape of menstrual blood. Instances of adenomyomata developing in the scars of the abdominal wall following cesarean section are reported by Cullen, Mallory, and others. W. S. Lemon and A. E. Mahle report nine cases of adenomyomata found in abdominal scars subsequent to pelvic operations of other types. N. S. Heaney remarks that of the twenty-nine cases of adenomata containing endometrium found in abdominal scars after operations, seven followed hysterotomy of pregnant uteri. He adds two such cases of his own, one following cesarean section, the other after hysterotomy in a patient six weeks pregnant.

Such observations apparently demonstrate the possibility of the development of adenomyomata from particles of endometrium transferred and grafted in ectopic foci.

Aberrant endometrium commonly exhibits the various changes of normal endometrium throughout the menstrual cycle. Decidual changes have also been found in such lesions coincident with a normal pregnancy. Moreover, it is more than suggestive that pelvic adenomata are commonly found at the very sites where one would expect such droppings from a tube to lodge—on the ovary, pelvic peritoneum, and in the culdesac. V. C. Jacobson has shown that bits of endometrium transplanted beneath the peritoneal surfaces of rabbits will grow, producing lesions histologically very like those resulting from human endometrial implants. The characteristic grumous content of the human ovarian endometrioma was not found in the experimental lesions in rabbits. In a recent report (*Arch. Path.*, Feb. 1926), this author describes ovarian endometriomata experimentally produced in monkeys where contents and tissue closely resemble their human counterparts.

It is evident that any variation in the caliber of the interstitial portion of the tubes would have a direct bearing on the likelihood of the regurgitation of the menstrual discharge from the uterus, and Sampson has shown that such a variation does occur, by studying roentgenograms of uteri injected with an opaque material.

Once bits of tubal mucosa or endometrium have fallen from the tubes they may become devitalized, or, falling on the ovary or pelvic peritoneal surfaces, they may grow and produce endometrial lesions including hematomata.

Primary peritoneal implants as a rule remain small and do not give rise to symptoms; occasionally they grow and spread.

Ovarian implants, on the other hand, are much more apt to become invasive. Secondary implants from the ovary, which seems to act as an incubator or vitalizing force, discharged by rupture of a hematoma, are apt to be more troublesome. At times the implants are influenced by the ovarian function and occasion a menstrual reaction comparable to that of normal endometrium.

Most ovarian implants are from a few millimeters to 3 or 4 centimeters in diameter, occasionally growing much larger. Atrophy, especially of the

smaller implants, often occurs, possibly as a result of pregnancy. Fortunately, most of these implants remain small, are not extensively invasive, and do not give rise to symptoms. Of sixty-four cases with implants found by Sampson, only nineteen had obviously caused discomfort. Symptoms arise chiefly from their reaction to menstruation, from resultant adhesions, or from invasion of the large intestine. Adenomyoma of the rectovaginal septum is prone to become obstructive as well as painful. It must also be remembered that it is possible for an ovarian endometrial implant, though originally benign, to undergo a degeneration (metaplasia) and thus gives rise to a malignant ovarian tumor.

The distribution of the endometrial transplants is characteristic and interesting. In his sixty-four cases, Sampson observed eighteen small surface implants in one or both ovaries, involving also other pelvic structures. In eighteen others, implants were noted in pelvic structures without evidence of primary ovarian involvement. In nine, small implants were found on the surface of one or both ovaries, without secondary transplants. There were eighteen ovarian hematomata from 0.5 to 15 centimeters in diameter, associated with adhesions and secondary transplants, including an adenomyoma in the groin and one in the round ligament. Intestinal implants were present in thirteen—eleven rectosigmoid invasions and one each of cecum and small intestine.

Sampson further states (*Surg., Gynec., & Obst.*, March, 1924): "Any endometrial implant, wherever situated, may not only invade the tissues on which it primarily develops, but may also invade adjacent structures with which it comes in contact. In the reaction to menstruation epithelium may also be cast off and give rise to other implants. The perforation of the ovarian hematomata, whether small or large, is apparently the chief source of these secondary growths. The ovary may be considered an incubator, hot bed, redistributing focus, or even intermediary host in the origin of these secondary implants, which, in some instances, may possibly impart greater activity (virulence) to the epithelium developing in it. This latter faculty, while apparently present, is difficult to estimate, as there is such a great variation in the degree of invasiveness of the implants in different cases. Many are small and chiefly of histological interest, while others may simulate malignancy in both their clinical and gross pathological manifestations. In some instances only primary implants are present, while in others these are both primary and secondary.

"The distribution of the implants in these cases is similar to that associated with malignant ovarian tumors, except that the latter are usually much more extensive. I have never found benign endometrial implants in the omentum, which is so often involved in patients with peritoneal carcinosis."

The study of inguinal endometriosis (adenomyoma of the round ligaments and elsewhere) suggested the possibility that a dissemination of benign endometrial lesions may be by way of the lymphatics or of venous sinuses (J. Halban, *Wien. klin. Wchnschr.*, 1924, 37: 1205; J. A. Sampson, *Am. J. Obst. & Gynec.*, 1925, 10: 462).

Possible sources of misplaced endometrial tissue may be summarized as follows:

1. Adenomyoma of the uterine wall due to direct invasion of the uterus from the endometrium; a similar condition also found in the tube. Invasion from the peritoneal surface of the uterus as a result of secondary implantation frequently occurs.

2. Implantation endometriosis.

3. Mechanical (postoperative) transplantation of endometrium in wounds

4. Metastasis by lymphatics or veins.

5. Embryonic misplacements.

It is a matter of the utmost interest, as suggested in our first paragraph, to decide whether or not the conditions here described are identical with or cognate to that other group of extraordinary tumors, recognized under the title adenomyoma, discovered in the late nineties, which excited such a lively interest in that distinguished von Recklinghausen. The name adenomyoma, by the way, while doing service as a caption, is somewhat misleading, for in such cases one after all is but dealing with an ectopic uterine mucosa (parenchyma) associated with myomatous or fibrous tissue (stroma). The name, however, seems to be well-established in our literature and is perpetuated as thoroughly understood. Only recently, F. Jayle of Paris, appreciating this inconsistency (*Rev. franc. de gynec. et d'obst.*, Jan., 1927), has given the adenomyoma the title of *solénome* (Greek *solēn*—a canal, a channel), emphasizing at the same time the fact that the gland is the only essential provocative part in the growth lodged in an enveloping stroma which is of secondary importance. The several terms—adenomyoma, endometrioma, solenoma—serve only to docket identical processes, as confirmed by the clinical, pathological, and microscopic findings, and are, therefore, interchangeable.

While acknowledging the strength of Sampson's contention as to the etiology of many of the pelvic endometriomata, it is not surprising to find differences of opinion developing. T. S. Cullen, for instance, cites instances which he believes could not possibly have sprung from implants. James Ewing and others, admitting Sampson's theory as in all likelihood accounting for some of the ectopic endometrial growths in the pelvis, believe that embryonic rests do also play a large rôle in many instances.

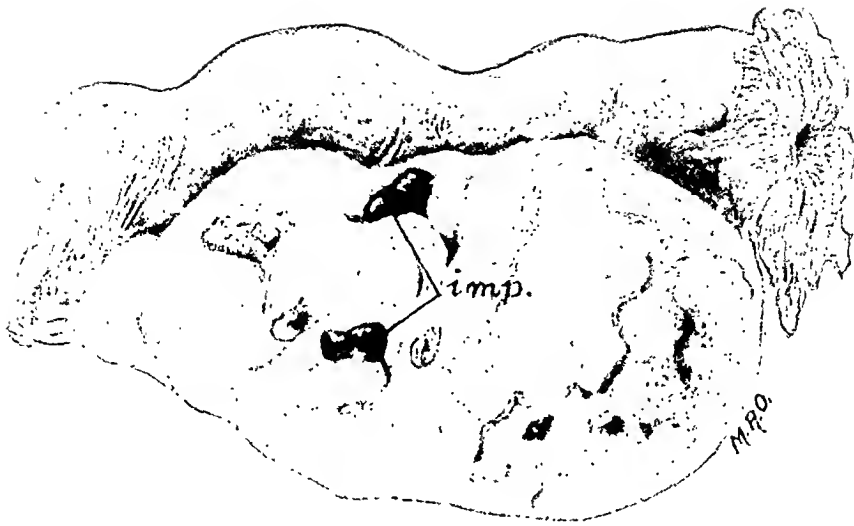


FIG. 652.—OVARIAN HEMATOMA.

Under surface of right ovary. Implants large with purple raspberry appearance. (J. A. Sampson.) $\times 1$.

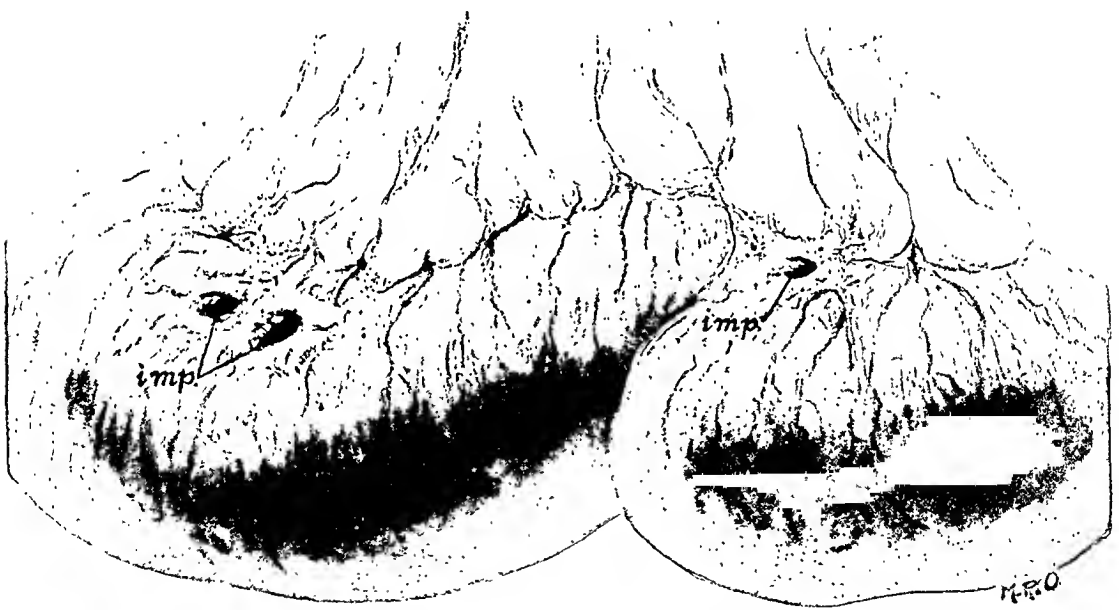


FIG. 653.—ENDOMETRIAL IMPLANTS ON TERMINAL LOOP OF ILEUM FROM SKETCH, NATURAL SIZE, MADE AT OPERATION.

These not excised but identical in appearance with those situated on ovaries and examined microscopically. (J. A. Sampson.)

E. Novak, after examining hundreds of tubes recently removed and finding endometrium in seven, removed in the interval of menstrual epoch, urges another source of origin and mechanism of distribution. He holds that the tufts of tissue finding lodgment on the peritoneum and occasionally in the tube in reality arise from the germinal epithelium of the ovary, which has simply been carried on to a more advanced degree of development to form endometrium—in other words, that an ectopic differentiation of the celomic epithelium may be a source of the aberrant endometrium; that any regurgitation of endometrium out through the isthmus into the ampullar portion of the tube is rare and endometrium so cast off is not viable; that these fragments are too large to pass through the lumen of the interstitial portion; that such a movement against the ciliary current is unlikely; and that the fragments are much more likely to originate in an ovary than first to find lodgment in an ovary which again becomes a distributive focus.

In addition there remains the group of cases in which the tumor is found in the rectovaginal septum, the round ligament, and the umbilicus, hard to imagine as arising in any other way than via embryonic rests.

C. F. Burnam writes, "Sampson should be accredited with the demonstration of the great frequency of endometrial tissue on the ovary and on the pelvic peritoneum. Until he showed us this condition, although we all had looked at it hundreds of times, no one had recognized what it was. His second important discovery was that blood cysts of the ovary are really nothing but ovarian adenomyomata or endometriomata. No one had ever thought of these blood cysts as epithelial tumors and much less as lined by epithelium with functions similar to endometrium. I really think that the question of implantation whether from uterus or ovary is of minor importance."

Treatment of Benign Ectopic Endometriomata.—Before Sampson's observations, small peritoneal endometriomata were left unrecognized. The large, so-called "chocolate" ovarian cysts were commonly resected, and adhesions dissected away. It is now recognized that the symptoms and continuation of growth of most implants are dependent upon the functional activity of the ovaries. Ablation of all ovarian tissue will be followed in the majority of cases by atrophy of the lesions and relief of the resultant symptoms.

Sampson advises removal of secondary peritoneal implants when easily possible. Intestinal resection, he believes, should rarely be necessary. Endo-thermy will unquestionably find a fruitful field in dealing with superficial lesions, sparking them out of existence without delay and without risk.

W. P. Graves (*Am. J. Obst. & Gynec.*, 1925, 10: 665-670) inclines to agree with Sampson that the majority of ectopic endometrial growths are due to secondary implantation. He also agrees that extensive growths, difficult and dangerous to resect, are best treated by ablation of all ovarian tissue. In support of this view, he cites three cases of extensive adenomyoma of the rectovaginal septum, as well as an interesting instance of adenomyoma in an

abdominal scar following a pelvic operation. In all four, all ovarian tissue was removed with resultant atrophy of the growths and a satisfactory recovery. In one, adenomyomatous infiltration had caused stricture of the rectum with

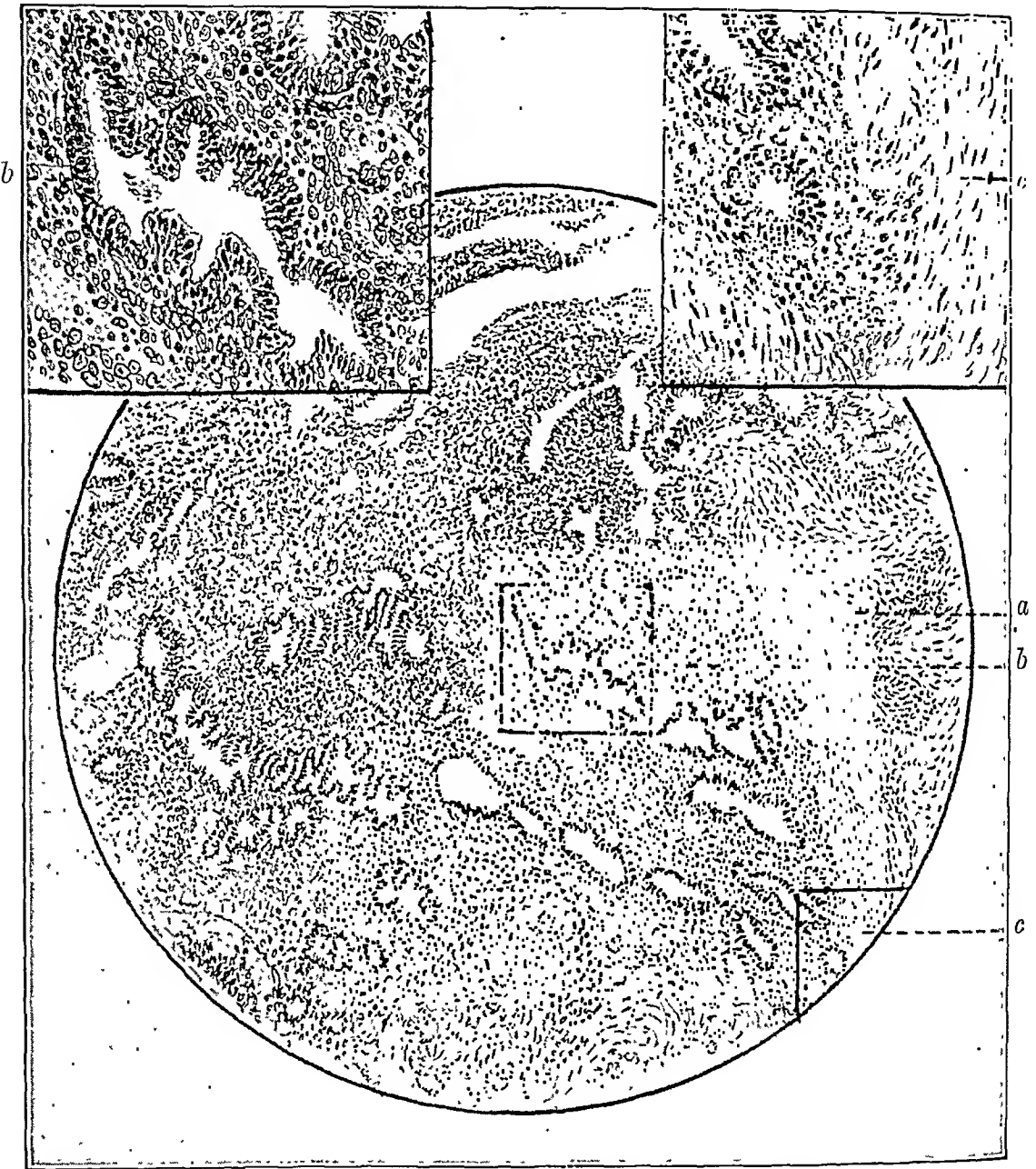


FIG. 654.—ECTOPIC ENDOMETRIUM FROM WALL OF RECTUM.

- a. Normal muscularis of rectum
- b. Typical premenstrual endometrial gland
- c. Endometrial glands and stroma invading muscularis

Chief symptom persistent pain, not associated with menses. Examination revealed indurated mass in floor of pelvis. One normal pregnancy seven years previous.

obstruction, and although the growth was unusually extensive, colostomy and oöphorectomy effected a gratifying cure, as the growth dwindled after operation until the colostomy was no longer necessary.

F. E. Keene also reports two remarkable perforating ovarian hematomata with extensive endometrial infiltration of the bladder, with severe symptoms. In both, a supravaginal hysterectomy was combined with bilateral salpingo-oöphorectomy, with no effort to resect the bladder arcas, the operators (Keene and J. G. Clark) merely excising enough vesical tissue to clarify the diagnosis. The first patient was entirely relieved when seen two years after operation, and the cystoscopic picture was that of a normal bladder. The second, when last seen two months after operation, showed a considerable regression of the invasive growth with great symptomatic improvement.

Graves concludes that the demonstration of a few cases successfully treated by ovarian ablation does not prove that all ectopic endometriomata may be cured in like manner, especially since Cullen gives evidence to the contrary.

We have but meager data from which to judge the possible value of the treatment by radium or x-ray. In our own experience direct radiation of adenomyomata with large amounts of radium has yielded little or no result. However, radiation of the ovaries instead of surgical ablation may prove ideal and should be tested.

Graves reports a suggestive and interesting experience in a woman of fifty treated by radium for uterine hemorrhage due to fibromyomata. In spite of the fact that her menstrual periods terminated with the treatment, an operation was necessary a year later to remove actively enlarging and painful chocolate ovarian cysts.

Malignant Implants of Endometrial Type.—If particles of normal endometrium can be driven through the tubes and deposited as grafts on the ovaries and pelvic peritoneum, it is extremely likely that malignant growths involving the uterine cavity would spread in like manner. Sampson and J. V. Meigs each have observed five instances of malignant ovarian tumors associated with and histologically the same as the accompanying malignant tumor of the uterus; particles of carcinoma have also been found free in the tubal lumina of patients with carcinoma of the uterine body. The distribution of the scattered foci of malignancy on the ovaries and pelvic peritoneum, analogous to the benign endometrial implants, is more than suggestive of direct tubal conduction.

In view of the possibility of expressing benign and malignant endometrial tissue out through the tubes on to the pelvic structures, it behooves the careful surgeon to avoid all manipulations likely to increase such a risk. Curettage, particularly in adenocarcinoma of the uterine body, if followed by a vigorous bimanual handling, may squeeze particles of malignant tissues out through the tubes.

Sampson also suggests that the manipulation of the uterus during a hysterectomy may contaminate the pelvic peritoneum in this way. Ligation of the fimbriated tubal extremities, as a first step in the hysterectomy, obviates the risk.

CHAPTER XL

BLADDER AND URETHRA

HOWARD A. KELLY

TOPOGRAPHY OF THE BLADDER

Natural Landmarks within the Bladder

Relation of the Bladder to Surrounding Structures

Conventional Division of the Air-distended Bladder into *Hemispheres and Quadrants*

EXAMINATION OF URETHRA AND BLADDER

Urinalysis

Percussion

Palpation

Inspection

URETHROSCOPY AND CYSTOSCOPY

Instruments

Technique

Examination

DISEASES OF THE URETHRA

Displacements

Prolapsed Mucosa

Stricture

Incontinence

Ischuria

Chronic Urethritis

Suburethral Abscess

New Growths

CARUNCLE

CARCINOMA

SARCOMA

FIBROMA

CYST

DISEASES OF THE BLADDER

Congenital

LOCULATE BLADDER

EXSTROPHY OF BLADDER

Displacements and Alterations

Foreign Bodies

Vesical Fistulas

ETIOLOGY

SYMPTOMATOLOGY

DIAGNOSIS

TREATMENT

General Principles

1. Freedom from Infection
2. Accessibility
3. Vascularization of Tissues
4. Area of Denudation
5. Approximation
6. Suture Material
7. Closure
8. Placing Bladder at Rest
9. Posture
10. Various Avenues of Approach
11. Instruments

Operation

1. Vesicovaginal
 - (a) Classical Procedure
 - (b) Closure by Detachment of Bladder
 - (c) Opening Peritoneum at Vaginal Vault
 - (d) Closure through Bladder
 - (e) Extraordinary Methods of Closure
2. Vesico-uterovaginal
3. Vesico-uterine
4. Enterovesical
5. Other Vesical Fistulas

Cystitis

ETIOLOGY

PATHOLOGY

SYMPTOMATOLOGY

DIAGNOSIS

*Urinalysis**Palpation**Cystoscopy*

PROPHYLAXIS

TREATMENT

*Acute Cystitis**Chronic Cystitis*

1. Elimination of Extravesical Foci
2. Irrigation and Instillation
3. Irrigation and Distention
4. Endothermy
5. Topical
6. Drainage
7. Excision

The bladder in women, until recent years, has been the stepchild of gynecology and neglected by urologists in general in their efforts to build up a new specialty within the domain of these diseases in the male. Honorable exception must be made to this statement by recalling the early fruitful labors of

Sims, Emmet, Simon, Jobert, Skene, and Bozeman. Newer methods of investigation have corrected this evil, and we have now a well-worked-out, clear-cut special field in the gynecological terrain full of interest and demanding acumen in diagnosis and a high skill in surgery.

We begin with the topography of the bladder, and devote some attention to the pelvic ureters, with some necessary consideration to the field of renal diagnosis, without attempting to do more in the latter field than indicate the fruitful methods of exploration and the possibilities of treatment.

TOPOGRAPHY OF THE BLADDER

It is advantageous to view the topography of the bladder, examined in the knee-chest posture, distended with air, from the standpoints of the natural landmarks within the bladder, the relations of the bladder to its surrounding investing structures, and a conventional division of air-distended bladder into hemispheres and quadrants. Familiarity with these enables one to observe and record lesions with great facility and equally to note and record progress under treatment.

Natural Landmarks within the Bladder.—The internal orifice of the urethra forms an important point of departure in the description of lesions extending from the bladder into the urethra, or in locating lesions limited to the area adjacent to the urethra; we have in this way a circumurethral area of a circle of say about 4 centimeters in diameter.

“Opposite the urethral orifice” is a convenient expression to designate a somewhat movable but always median area of the posterior vesical wall, first seen on withdrawing the obturator.

The ureteral orifices are the most important natural landmarks used to describe lesions in their immediate neighborhood as ureteral, interureteric, or posterior, anterior, or lateral to one or the other.

In the knee-chest posture, the ends of the ureters sometimes stand out prominently on a truncate cone from 3 to 5 millimeters in diameter at the base and from 2 to 4 millimeters high with the orifices at the top or a little to the anterior inner side, an eminence I call the *mons ureteris*—a valuable landmark in the accurate location of minuter lesions directly about the orifices.

I give the name “ureteral folds” to marked rounded elevations in the vesical mucosa, about 2 centimeters long, sometimes seen in the knee-chest posture, stretching from each ureteral orifice outward and backward toward the pelvic walls, manifestly corresponding to the terminal portions of the ureters passing through the bladder wall, more resistant and standing out when the rest of the bladder expands with air. They also correspond to Pawlik’s folds in the vagina, and were used by him as a guide in catheterization.

The vesical triangle or trigonum, Figure 655, with its apices at the ureters and the internal urethral orifice, defines an area resistant to atmospheric dis-

tention, about 2.5 centimeters wide at the base and 2 centimeters on the sides. It is distinguished by its deeper injection from the rest of the mucosa, and is a most important landmark.

The interureteric ligament connecting the ureteral orifices is a distinct fold in the distended bladder, elevated above the level of the bladder and behind it, usually defined as a ridge separating the deeper injection of the trigonum from the paler mucosa of the posterior part of the bladder.

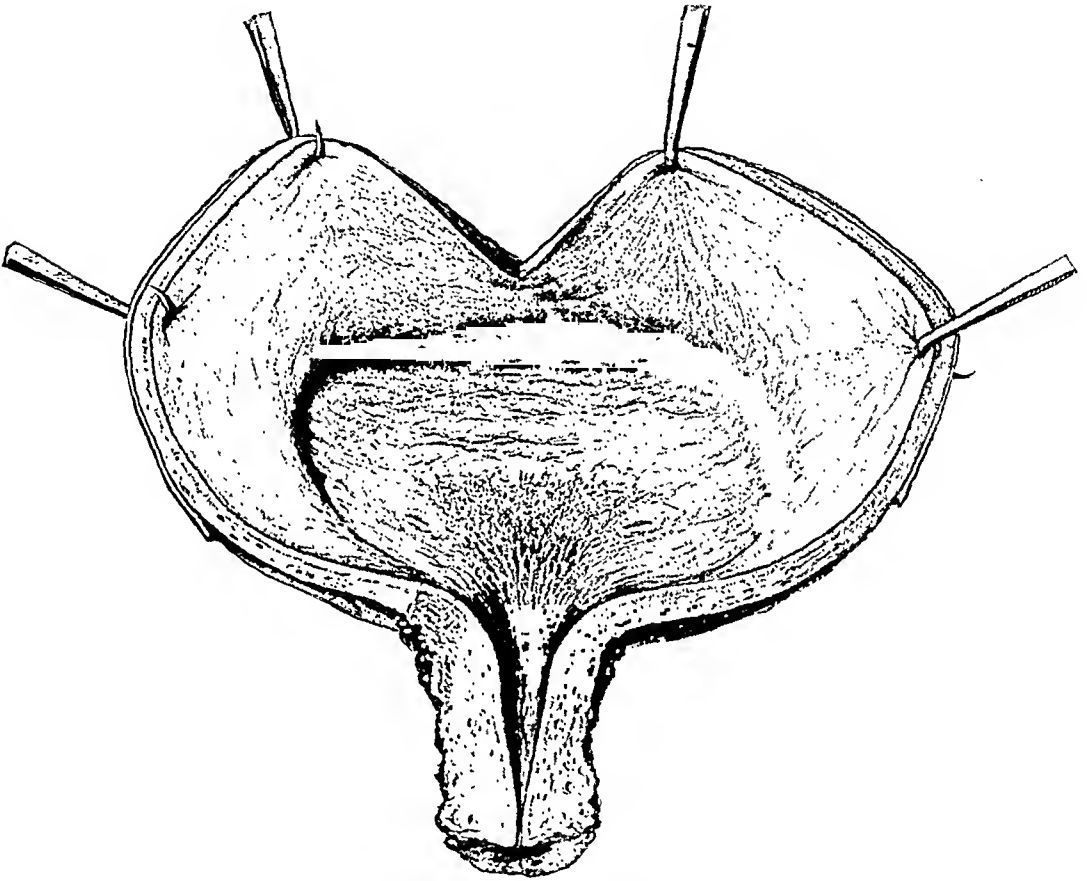


FIG. 655.—NORMAL BLADDER LAID OPEN BY AN INCISION THROUGH ANTERIOR WALL.

Ureteral orifices seen as narrow slits at posterior angles of trigonum; third angle at internal urethral orifice. Trigonum characterized by its increased vascularity between these three points. Longitudinal vesical folds entering urethral orifice well shown.

Important points of reference also are those relating to the fixed and the movable portions of the bladder. As the bladder empties itself, the upper, more movable peritoneal portion settles down into its lower and relatively more fixed base closely connected with the vagina, until it reposes as one saucer nested in another. In respiration the free upper half often moves on the lower as if hinged on a transverse line of demarcation. This difference between mobility and relative immobility seems in some measure to determine the location of the inflammatory affections, which are particularly apt to involve the cornua at the right and left posterior angles.

At the edges where the saucers meet, three folds are formed, best seen in the dorsal posture with but little elevation of the pelvis. I call these the plicæ vesicles right, left, and posterior. The posterior fold stretches from side to side in front of the uterus and is slightly convex forward, ending well out on each side in front of the broad ligaments where the lateral folds begin and extend horizontally around toward the urethra. These folds represent physiological hinges of the bladder in expanding and collapsing. I call the apices where the posterior fold meets the lateral, the right and the left vesical cornua, among the more important natural landmarks.

Relation of the Bladder to Surrounding Structures.—The relationship of the bladder to its enveloping structures is important on account of its liability to participation in their diseases.

The upper half of the bladder is covered with peritoneum and may be called the subperitoneal area. This does not include the area above the urethral orifice, in relation to the space of Retzius and the symphysis pubis—the symphyseal area.

The trigonum and a broad strip of tissue extending back from it lie in close relation to the anterior vaginal wall—the vaginal area of the bladder. Just above this vaginal area is a narrow strip in close relation to the supravaginal cervix uteri, as far up as the internal os, constituting the important uterine area. Laterally the broad ligaments are in contact with the right and left cornual regions and the pelvic walls.

Conventional Division of the Air-distended Bladder into Hemispheres and Quadrants.—Postural air distention of the bladder forms an irregular hollow sphere, flattened anteroposteriorly, and the cystoscopist peeps through a hole in its side wall much as the children ogle their hollow sugar Easter eggs. By turning the speculum in various directions, all parts of the anterior, even those nearest the speculum, come into view.

Conceive then of such a bladder as a mathematical figure divided by a sagittal plane into right and left hemispheres easily discerned. A point opposite the end of the speculum, about halfway between base and vertex, forms a posterior corresponding to the internal urethral orifice which is the anterior pole. With a fixed posterior and an anterior pole, we then imagine the bladder as further divided by a horizontal plane into quadrants.

By these simple devices, irregular patches of disease can be fairly accurately mapped out on a diagram and subsequent alterations in form and extent easily noted.

The chief use of this latter system is in posterior lesions where no natural landmarks are available.

The extent of lesions on the vesical walls can be measured for a record either by a trained eye which estimates the size accurately when the patch is not too large, or by using the known size of the end of the speculum as the measure.

EXAMINATION OF THE URETHRA AND BLADDER

There are, in general, four ways of making a physical examination of the urethra and bladder; namely: Urinalysis, percussion, palpation, and inspection—that is to say, urethroscopy and cystoscopy.

Urinalysis.—The fullest physical, chemical, microscopic, and bacteriologic examination of the urine should be made in every case where morbid changes are found. If the urine is in any way abnormal, and especially if it contains pus or blood, a catheterized specimen must be taken. As a rule, voided urine is contaminated in the act and is therefore misleading.

The color, odor, and specific gravity must be noted, together with the degree of alkalinity or of acidity, and the presence of albumin, sugar, pus, blood, mucus, or fragments of stone. Minute stones can sometimes be seen under a weak lens and tested microchemically. The microscope may reveal pus corpuscles and blood, even in minute quantities, as well as casts and various crystalline substances. Bacteria are noted and identified by staining and culture methods. Bits of tissue and epithelial cells are examined. The bacteriologic examination of an uncontaminated (catheterized) specimen of urine sometimes reveals at once the nature of the disease, as in tuberculosis, gonorrhea, or a colon bacillus infection. It is often convenient to take urine for examination direct through the cystoscope.

As a rule, in inflammatory diseases of the urethra, sufficient secretion can be brought to the meatus for a cover-slip examination by stroking it from above downward on its vaginal surface. After exposing the inner surface of the bladder, secretions clinging to the bladder wall, or issuing out of a sinus or from a ureteral orifice, become available for examination when picked up on a platinum loop.

Percussion.—Percussion is of use in outlining a bladder full of urine. If percussion over the lower abdomen yields everywhere a tympanitic note, the bladder cannot be more than moderately distended. A decided fluctuating swelling above the symphysis with a flat percussion note all over the enlargement and a corona of resonance above and at the sides and a dull base below, often indicates a distended bladder which becomes most evident to a bimanual examination.

After an aëroscopic examination of the bladder, the overlying abdominal wall yields a high-pitched, tympanitic note until the air is evacuated.

Palpation.—Precious information is gained in urethral and vesical diseases by touch alone, the changes noted relating to sensitiveness and to variations in form or consistency. The urethra is palpated indirectly through the anterior vaginal wall by rolling the index finger over it from side to side, pressing upward, and using the under and the posterior surfaces of the symphysis as a point of counterpressure. An inflamed urethra is tense and swollen, and pressure elicits pain; a suburethral abscess feels like an elastic round lump

projecting into the vagina and emptying on pressure; a cancerous urethra is hard and fixed like a rigid cord, and is often nodular.

The external urethral orifice is best felt with the index finger pressing up on to the symphysis just above the vaginal outlet where an inflamed orifice or a sensitive caruncle is intolerant of pressure. If the urethra is excessively dilated, as from coitus in atresia of the vagina, the finger may inadvertently enter the bladder as readily as a capacious vagina. On each side the infected Skene's glands often feel like little ends of wire embedded.

On palpating the empty bladder bimanually between two fingers in the vagina and a hand pressing down over the symphysis, the fingers can be

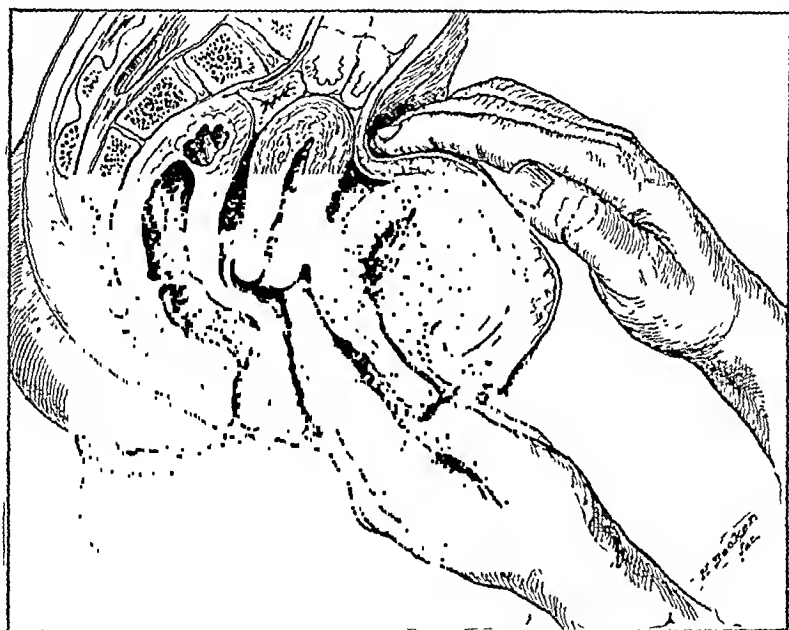


FIG. 656.—TUBERCULOUS CYSTITIS.

Markedly thickened vesical walls; method of palpating bladder bimanually.

brought close together, with only the abdominal wall, vagina, and the walls of the bladder intervening; by carrying the fingers back in the direction of the cervix, the posterior margin, where the empty bladder is reflected on itself, is often distinctly felt slipping forward from under the pressure. In cystitis, pain is elicited by this manipulation; in advanced tuberculous cystitis the thickening in the bladder walls is easily appreciated; in one case the bladder was big and hard like a hen's egg, Figure 656. A tumor is often felt, but should be subjected only to gentle pressure. Occasionally a stone or foreign body is caught and outlined.

Sometimes a better way to palpate is to put the patient in the knee-chest posture and let air into the vagina, when the fingers of both hands come together and the organ is felt with wonderful distinctness. The time has forever gone by for dilating the urethra with the index finger to palpate the interior of the bladder, or even for using large bougies to this end, as recommended by Simon; the risk of an incurable incontinence is too great.

Inspection.—Direct inspection is the most fruitful of all methods. Without instruments one can learn much. Diseases of the urethral orifice are detected, and by drawing the urethral labia apart the lower end of the canal is exposed, including the orifices of Skene's ducts posteriorly and laterally. Retracting the vaginal outlet, the vaginal surface of the urethra and the floor of the bladder are seen, and a tumor of the urethra projecting into the vagina, or a displacement of the bladder (cystocele), or a vesicovaginal fistula becomes visible; also a cancer of the cervix involving the base of the bladder.

Urethroscopy and Cystoscopy.—The interior of the urethra is best examined with a short speculum, 8 to 10 millimeters in diameter, introduced and withdrawn gradually, meanwhile studying the mucosa as each successive part of the canal falls over the lumen of the speculum. At first, the end of the speculum, emerging from the bladder, clears the rim of the internal urethral orifice and then, on continuing the withdrawal, approaches the center, the endoscopic picture resembling a flat funnel; the portion in the middle where the urethral walls come together is the central figure, and the area between the central figure and the speculum is the funnel wall.

The central figure is large and open only at the internal urethral orifice, where it is at first almost as big as the speculum, decreasing in size as the speculum is withdrawn until the walls approach on all sides and form a small quadrilateral or oval figure, finally closing altogether; lower down in the urethra the central figure forms a transverse line which finally assumes a vertical direction at the external urethral orifice. In incontinence the closure of the internal orifice is sluggish.

The funnel walls are made up of numerous folds radiating out from the central figure to the margin of the speculum. Numerous delicate vessels,

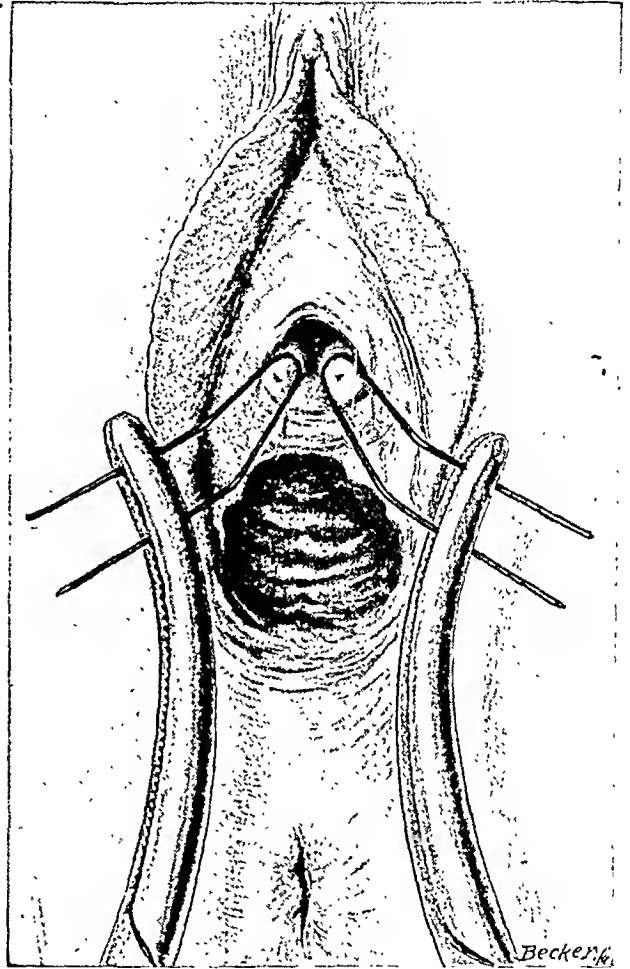


FIG. 657.—BENT HAIRPINS GRASPED IN ARTERY FORCEPS AND USED AS A SPECULUM TO EXPOSE ANTERIOR PORTION OF URETHRA, MORE PARTICULARLY ORIFICES OF SKENE'S GLANDS.

coursing longitudinally, are plainly visible, one or two on each fold, being more or less prominent according to amount of injection.

In the lower urethra, near the external orifice, there is a transverse fold, subdividing the urethral mucosa into a kind of latticework with shallow pits.

The orifices of the urethral glands, Morgagni's glands or Littre's acinous glands, appear as fine points, often in groups disposed longitudinally, or as larger yellowish spots; they can be better seen by changing the position of the speculum, displacing the central figure and bringing one side of the urethral wall flat against its end. As the speculum is withdrawn, the secretion of these glands accumulating in the lumen likely to be mistaken for pus should be taken up on a swab and examined microscopically.

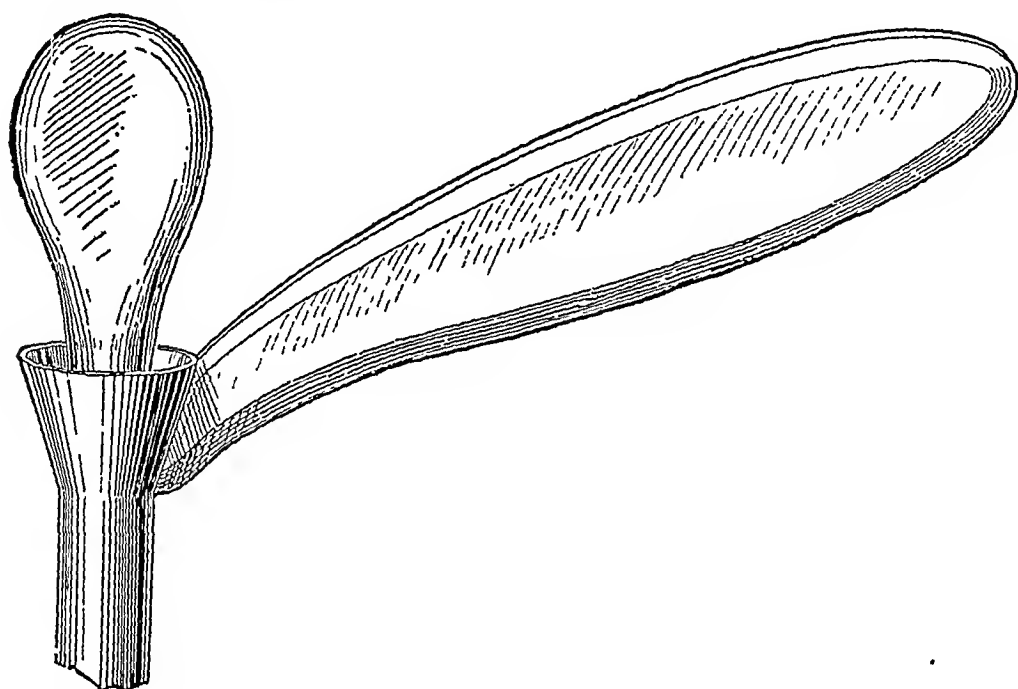


FIG. 658.—A STOUT HANDLE ATTACHED TO NO. 10 VESICAL SPECULUM, MORE CONVENIENT THAN A SHORTER ONE.

One of the best ways of examining the outer end of the urethra, and especially the orifices of Skene's glands, is to bend two hairpins (Figure 657) and grasp them with forceps and use them to retract the urethral labia and walls.

The fundamental principles of the cystoscopic examination are: A simple cylindrical speculum introduced into the bladder; the postural atmospheric distention of the bladder—knee-chest, elevated dorsal, or elevated lateral (Sampson); the illumination and inspection of the vesical mucosa, either by means of a direct light, such as a little electric light attached to the forehead or fixed inside the speculum, or by a strong light held over the sacrum and reflected by a head mirror. Such a view of the bladder is a direct one, with no intervening medium, while the open speculum allows the operator to touch any part of the bladder with a sound and to introduce a great variety of instruments, and ureteral catheters.

I n s t r u m e n t s .—The few necessary instruments are: A strong light, a head mirror, several vesical specula, a urethral calibrator and dilator in one, an evacuator for removing urine, long forceps, and a searcher.

1. **Light.** The best illuminant is the strong electric light in a blue glass globe, with a simple oval tin reflector covering half of it and painted white. Strong daylight or sunlight gives a good illumination but is uncertain and awkward to use, necessitating shifting the patient instead of the mirror.

2. **Head mirror.** The head mirror is a simple concave reflector with about 30 centimeters focal distance. A large circle of light thrown by this mirror around the orifice of the speculum is necessary, since, if the circle were

small, the slightest movement of the examiner's head would darken the field; a large circle allows latitude of movement. I like the mirror attached to an adjustable hard rubber band put on like the rim of a hat. A steel segmented band, covering and folding over and protecting the mirror when out of use, is convenient for transportation.

3. **Vesical specula.** The specula are simple nickel-plated metal cylinders 8 centimeters long and equal in diameter throughout. A stout handle, 8 centimeters long, attached to a funnel-shaped expansion at the outer end, affords a convenient grasp,

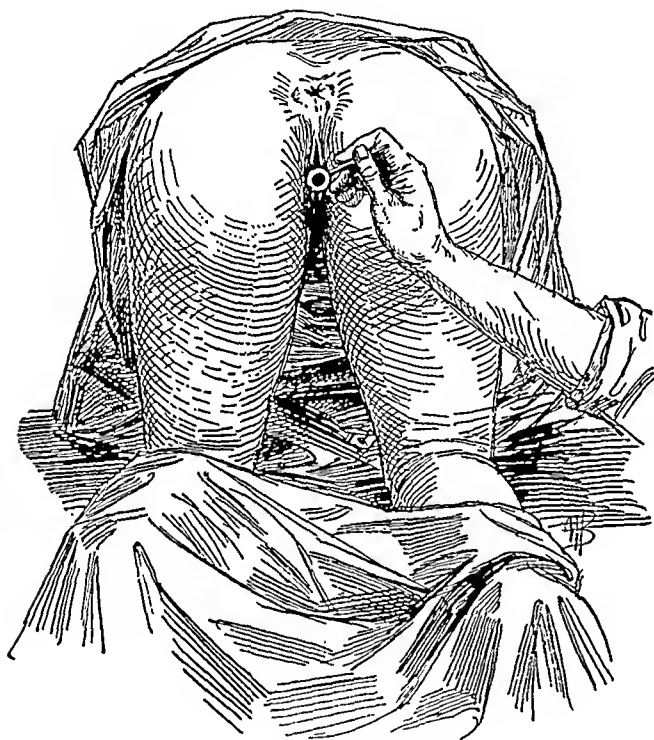


FIG. 659.—VESICAL SPECULUM INTRODUCED WITH PATIENT IN KNEE-CHEST POSTURE.

Figure 658. The vesical end of the speculum must be rounded a little, avoiding a ragged or a knife edge, Figure 659.

Specula are made in numbers from 5 to 20, each number representing the diameter of the cylinder in millimeters. It is also convenient to have on hand the half sizes from 6 to 12. Sizes below 12 are for examination; higher numbers afford a larger field for vesical operations.

Each instrument has its obturator, Figure 660, rounding out the end of the speculum during the insertion, the obturator ending in pointed cone.

4. **Dilator.** The dilator used to expand the external urethral orifice is conical, 7 centimeters long, Figure 661, and graduated.

In place of this conical instrument well adapted to enlarge the external ori-

fice where the resistance is most marked, one may use with great advantage the series of Hegar dilators.

5. Evacuator. An evacuator is necessary to empty the bladder of its residual or accumulating urine—a hollow tube with a small rubber exhausting bulb on the end.

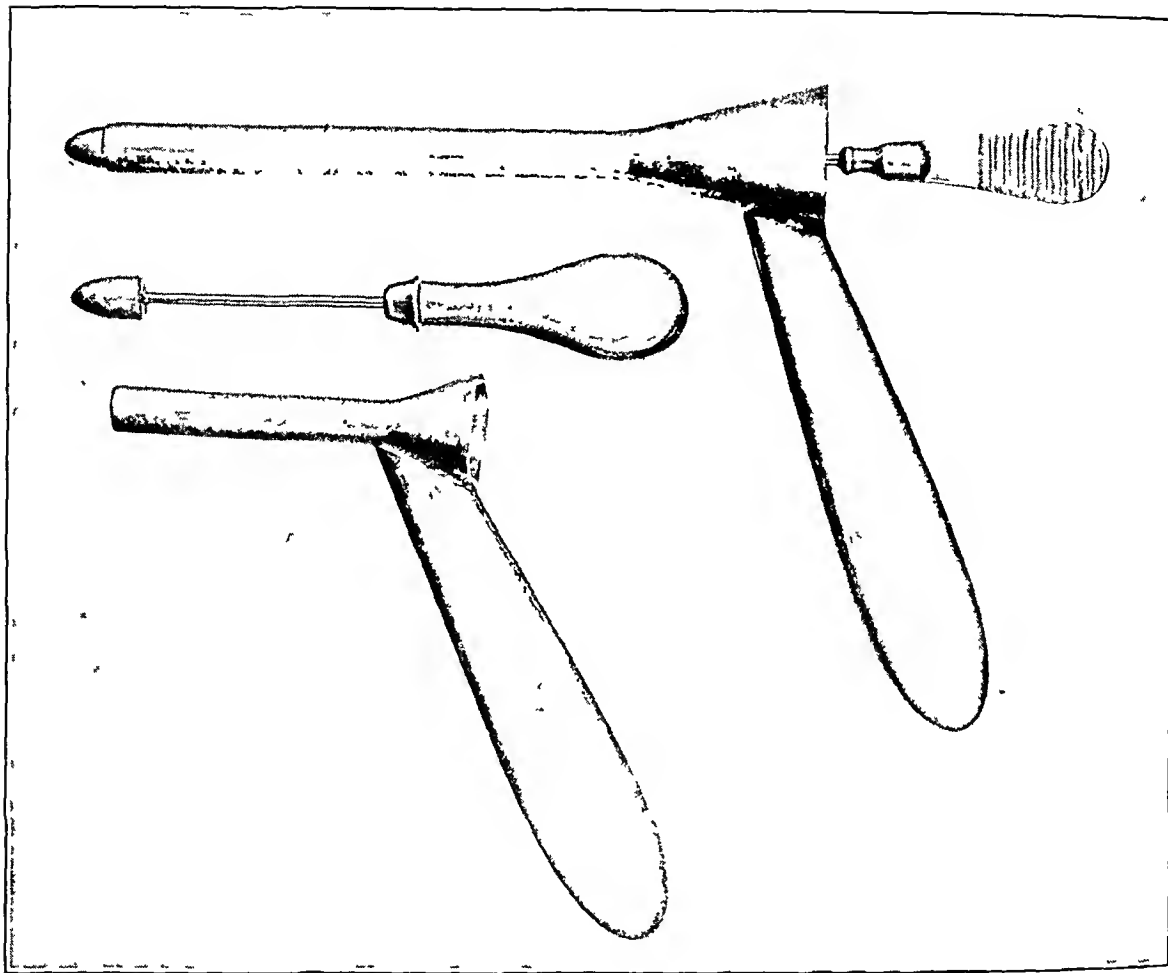


FIG. 660.—CYSTOSCOPE AND OBTURATOR.

Cystoscope 5 millimeters in diameter with inner lumen of 4 millimeters, about smallest size used. Long handle attached to funnel affords convenient grasp in introducing and holding it in position.

In the knee-chest posture, a pool of clear urine in the vault of the bladder often in no way interferes with a thorough inspection.

6. Forceps. Alligator forceps, Figure 662, are useful in cleansing the lumen of the speculum from drops of urine, or in taking up a little urine out of the bladder with small pledgets of cotton, or in wiping off small areas of the vesical mucosa, or in grasping a bit of tissue or a foreign body.

7. Searcher. The ureteral searcher is a small rod 18 centimeters long, Figure 663, used to test resistance in the bladder wall, to explore a sinus, and particularly to locate the ureteral orifices in doubtful cases.

A piece of flexible copper wire about 15 centimeters long, with a rough-

ened end, or the slender sticks used in throat work armed with a pledget of cotton, serve as applicators in bladder and urethra.

T e c h n i q u e.—1. Asepsis. Asepsis must rule in every examination by aseptic instruments, introduced by clean hands. All the instruments used must be sterile and conveniently laid in order, as they are likely to be used, on a towel:

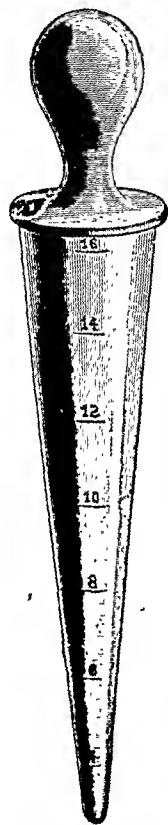


FIG. 661.—URETHRAL CALIBRATOR AND DILATOR.

Numbers indicate diameters in millimeters.

2. Preparation of the patient. The patient should come to the examining table with the bowel well emptied. The bladder does not expand so readily just after a full meal.

3. Anesthesia. The external urethral orifice is wiped clean with a boric acid solution and a pledget of cotton saturated with a 10 per cent solution of novocain inserted for ten minutes. A general anesthetic, awkward in fat women in the knee-chest posture, is advisable for the first thorough examination in a nervous woman, or when the bladder is much inflamed and extremely sensitive.

4. Posture. The knee-chest posture is most satisfactory, the patient kneeling with knees slightly separated and near the end of the table, with more or less vertical thighs and buttocks as high as possible, and the face turned to one side down on the table and elbows spread. Sometimes a little squatting, dropping the buttocks slightly, facilitates the inspection. Again, it may be necessary to push the thighs over beyond the vertical. Under an anesthetic, the best hold is an assistant on each side close to a thigh, with one hand grasping the body above the pelvis with the arm over the back, and with the other gripping and fixing the leg by a hold in the crotch of the knee, Figure 664. When a patient is puzzled to know what she is to do, I adopt the suggestion of one of my nurses and tell her the first step is to get down

on the table as though she were about to scrub the floor.

5. Dilatation of the urethral orifice. If the urethra is small, the lubricated dilator is introduced with a slight boring motion, until the required distention of 9 or 10 millimeters is reached.

An unusually small and rigid orifice may be cut posteriorly, and closed later with suture. The calibration of the urethra before dilatation should be recorded.

6. Introducing the speculum. The examiner now selects a speculum, No. 7, 8, 9, or 10, according to the size of the canal; a patient with a sensitive urethra may often be treated by an experienced examiner with less discomfort and with equal facility through a 7½ or 8 instrument. Beginners demand larger specula, 10 or even 11, but with experience they readily drop a size or two, Figure 665. The speculum lightly held as shown now enters the

urethra and passes on up into the bladder with a gentle sweep over the pubic arch, and the obturator is withdrawn. With an internal urethral orifice drawn well into the pelvis by the posture, there is danger of injuring the posterior wall of the urethra by thrusting the end of the speculum hard against it, an accident avoidable by raising the handle and following the strong curve. As the obturator is removed with a little twist, the air rushes in and the bladder is inflated and ready for inspection.

When the bladder does not expand, the examiner may assume that the patient is not in position, and a dropping in of the back or a pillow taken from

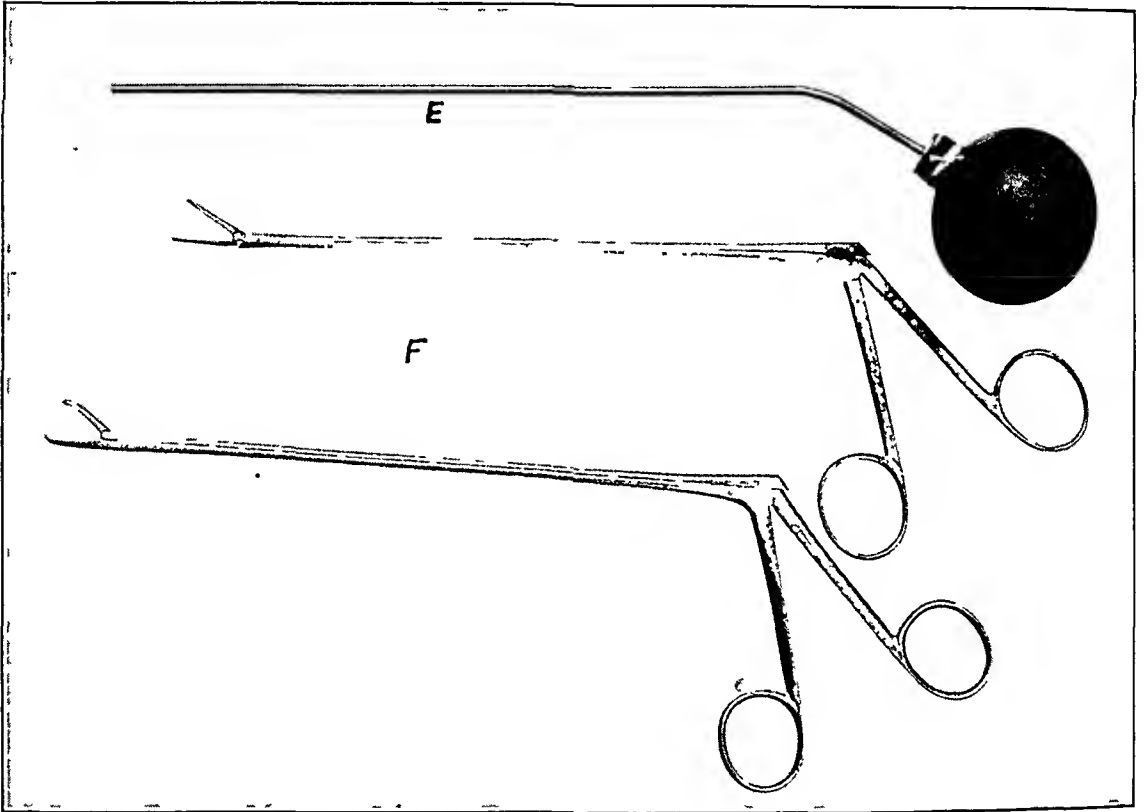


FIG. 662.—*E*. EVACUATOR FOR EMPTYING BLADDER IN KNEE-CHEST POSTURE. $\times \frac{2}{3}$.
F. ALLIGATOR FORCEPS FOR MAKING APPLICATIONS OR REMOVING FOREIGN BODIES OR BITS OF TISSUE FROM BLADDER. $\times \frac{2}{3}$.

under the face or a flattening out of the elbows on the table, corrects the fault. At times the distention takes place slowly as the viscera drop toward the diaphragm, as in proctoscopy.

Examination.—It takes far less time to view the whole interior of the bladder than it does to read a ten-line paragraph, Figure 666; indeed, after practice, a few seconds will determine in a preliminary way the presence or absence of any gross disease.

To proceed in an orderly manner, the examiner wearing a head mirror sits on a stool with his eyes a little below the level of the urethra, grasping the handle of the speculum which is turned upward.

The electric droplight is held close to the lower sacrum, protected from its heat by a folded towel, and the lower margin of the head mirror is turned (automatically with practice) until the reflected light zone falls within the

FIG. 663.—SEARCHER FOR LOCATING URETHRAL ORIFICE
SIMILAR TO DESORMEAUX'S PROBE.

bladder. The inexperienced is vexed for a time with the apparent waywardness of the spot of light.

The inspection begins with the hemisphere opposite the internal urethral orifice, from 3 to 5 centimeters from the anterior wall but not more than 2 or 3 centimeters from the end of the speculum well within the bladder. This whole hemisphere is first examined as the end of the instrument sweeps from right to left and is alternately raised and dropped so that the entire mucosa is reviewed at least twice.

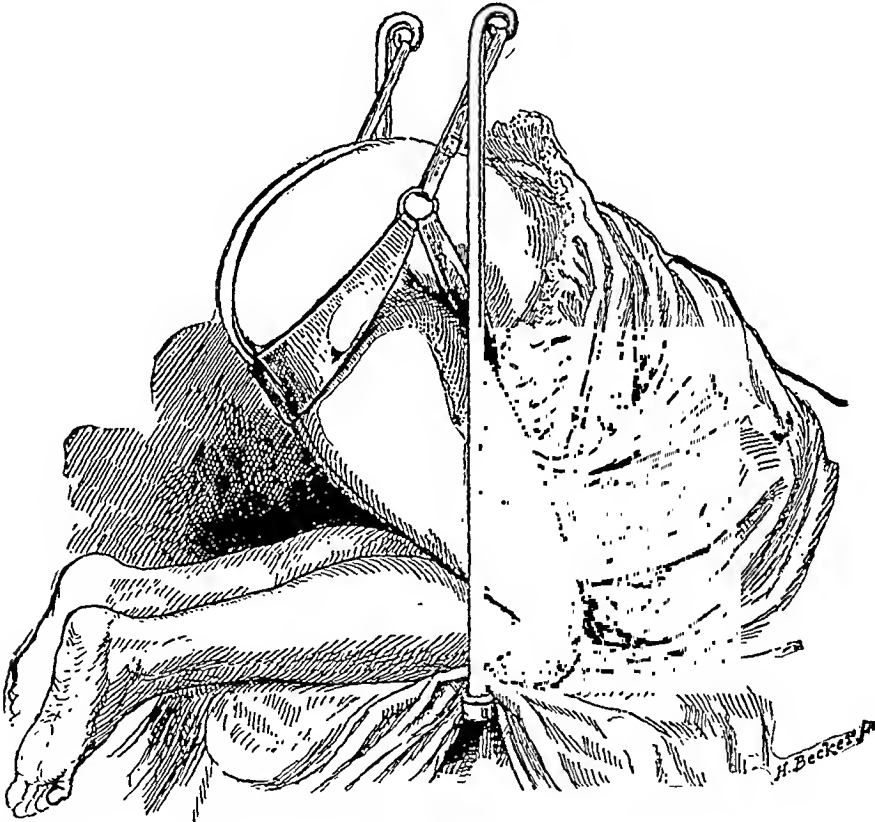


FIG. 664.—PATIENT IN A HARNESS IN KNEE-CHEST POSTURE FOR CYSTOSCOPIC EXAMINATION.
Squatting attitude a little too exaggerated for average case.

The normal background of the inflated bladder appears dull white, with vessels coming out of the depths, and coursing superficially, branching and anastomosing irregularly. Occasionally an artery is seen pulsating, or a large dark vein is followed until it disappears under the mucosa.

The fine rosy capillary injection of a contracted bladder disappears with air distention. A red spot of capillary injection is often seen at a point just opposite the urethra, easily mistaken for a localized inflammation, but due to a suction hyperemia induced by the contact with the end of the speculum and the withdrawal of the obturator.

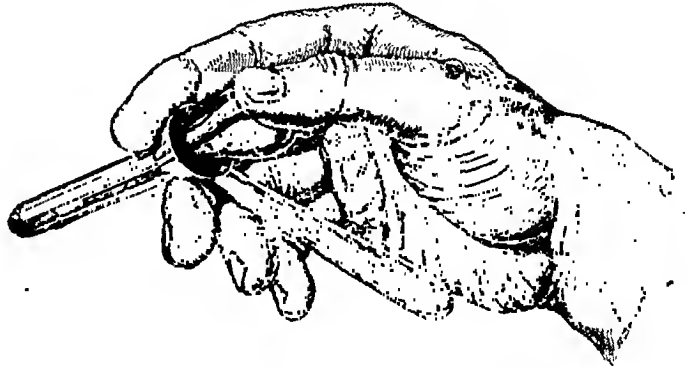


FIG. 665.—HOLDING VESICAL SPECULUM READY FOR INTRODUCTION; THUMB PRESSES OBTURATOR FIRMLY IN.

The mucous surface on the right and on the left of the posterior hemisphere is often intersected by shallow interlacing ridges, or again a sharp ridge 2 to 3 centimeters long, made up of inner irregular muscular bundles, crosses the field obliquely. Glistening points here and there are due to moisture on slight inequalities of surface, reflecting light.

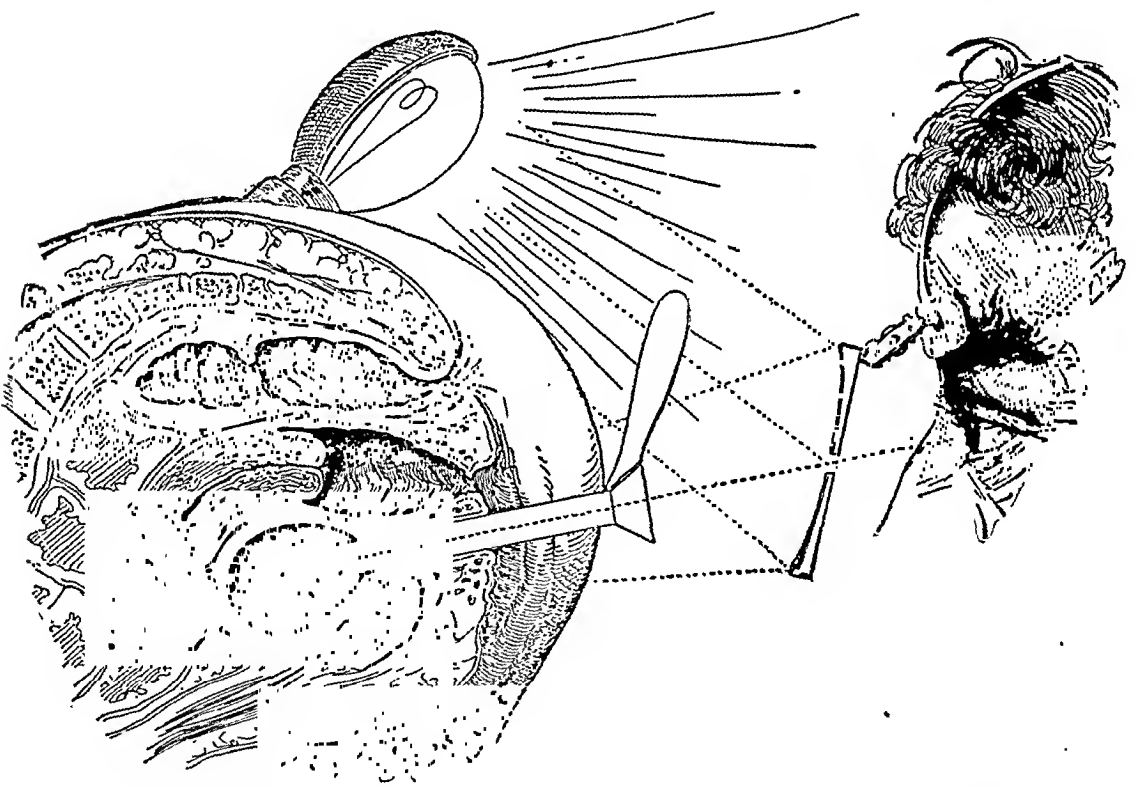


FIG. 666.—EXAMINATION OF BLADDER WITH PATIENT IN KNEE-CHEST POSTURE.

By raising the handle decidedly and looking down, the vertex is brought into view and inspected from side to side. By moving it to the left and then to the right, the lateral walls are reviewed. Next, lowering the handle decidedly, as the examiner kneels on a cushion and looks upward, the floor of the bladder appears and is reviewed in the same way.

The only parts which remain unexamined are adjacent to the internal urethral orifice, brought into the field by strong displacements of the internal orifice, using the handle as a lever.

The vesical triangle comes into view as part of the base by withdrawing the speculum until the inner end lies 1 or 2 centimeters inside; this is always more injected than the rest of the bladder, due to the intimate union of the mucosa with the underlying tissues, preventing this part from expanding and becoming anemic like the rest. The significance of the degree of redness of this area is sometimes hard to estimate.

Turning the speculum from 15 to 20 degrees, to the right or to the left, a little pinkish prominence is seen—the mons ureteris, marking a ureteral orifice and often looking like a fine transverse line about 2 millimeters long on the side of the mons, or like the faint streak of a water line on paper. Again the orifice is a little pit or a mere point. Immediately around the orifice is a paler area about 1 millimeter broad, and surrounding this a rosy zone 3 or 4 millimeters broad. One occasionally sees a blood-vessel emerging from the orifice on to the vesical mucosa.

Watching a ureteral orifice for half a minute or so, a little urine spouts out away from the surface, and forms a jet lasting two or three seconds, to be repeated again in

the course of a minute. Sometimes the spurting urine shoots down the lumen of the speculum as if squirted from a syringe. By holding the speculum up to the ureter or by using an oblique end speculum, enough urine can be caught directly as delivered from the ureter to answer the requirements of a physical, chemical, and microscopic examination. When the bladder is inflamed or ulcerated, it is sometimes advantageous to take the urine in this way and avoid catheterizing and opening up the ureteral area above. Now and then a bladder is found undergoing rhythmic contractions for a half minute or more, growing red and forming folds like a labyrinth of cerebral convolutions. After a half minute, the contraction relaxes, the bladder expands, and the examination can be continued.



FIG. 667.—THE LEFT URETHRAL LABIUM AS IT APPEARS ON THE SIDE OF THE CALIBRATOR WHICH IS INTRODUCED FOR THE PURPOSE OF DEMONSTRATING ITS PRESENCE.

External urethral orifice with fimbriated labia.

Insufficient air expansion occurs in advanced pregnancy, in the case of a tumor blocking the pelvis, or in ascites.

The field of usefulness of the cystoscopic method just described is a large one commensurate with the entire field of vesical diseases, and the practitioner using it liberally will be rewarded repeatedly by accuracy in making diagnoses without loss of time and by the discovery that affections hitherto estimated as functional exhibit definite local lesions.

I would insist that a cystoscopic examination be made in every case where a vesical complaint is more than transient and the diagnosis is not clear.

DISEASES OF THE URETHRA

The female urethra, much shorter and of larger caliber than the male (*"brevior et laxior,"* Celsus), is in like degree less liable to disease. The two commonest in my experience are urethritis of varying degree and a partial loss of control causing dribbling.

Displacements.—The external orifice may be displaced from a point just behind its normal position and under the symphysis, all the way back to one in the anterior vaginal wall in the neighborhood of the internal orifice. The urethral defect is mainly an aplasia of the posterior wall, leaving the more delicate pink mucosa of the anterior wall exposed. When situated higher up or associated with the absence of the upper vagina in married life, the urethra may undergo extreme dilatation with incontinence. This latter condition is sometimes relievable by sewing up the slitlike opening and reconstructing a urethra of sufficient length, and at the same time reconstructing a vagina.

A urethral displacement is common after a severe forceps labor; the anterior vaginal wall is preternaturally mobile and on standing the urethra with its cushionlike vaginal eminence rolls down and out with the lax vaginal walls. This requires no treatment *per se* but responds to a thorough treatment of the vaginal displacement.

Prolapsed Mucosa.—A more or less complete eversion of the mucous membrane of the urethra is found in rare instances. While the rest of the urethra remains in its normal position, the mucosa becomes loosened from its submucous attachments and is gradually extruded at the external orifice, forming a pale, deep red, or bluish tumor which swells and becomes edematous and even gangrenous. The protruding mass is tubular and lined by the sensitive, easily bleeding mucosa. No age is exempt, but the higher grades are commoner in children; in two the age was seventy and seventy-two.

The prime factor of the affection is usually an underlying struma, but with the immediate provocative of straining or coughing.

By compressing the tumor on all sides and at the same time pushing it back into the urethra, a replacement may be effected which will prove permanent; the patient should be kept in bed and a vulvar compress applied. If the

tumor cannot be replaced, or if it escapes again directly after replacement, an operation will be necessary, and the best is the excision of the protruding portion with knife and scissors, followed by a carefully applied continuous suture of fine catgut, uniting the cut edges and checking the hemorrhage. It is important to catch both edges as they are cut, to prevent an inversion with excessive hemorrhage.

Inflammation of the mucosa produces an eversion at the internal orifice, a common affection analogous to the eversion of the cervical mucosa. It is often extremely sensitive and bleeds readily.

Stricture.—Stricture in women is uncommon and is usually due to a gonorrheal urethritis.

The symptoms of stricture are difficulty and pain in micturition, increasing as the caliber lessens. I well recall my first case, a woman of about fifty-two, from whom I removed a large number of gallstones, who could not void while on her back, nor could the nurse catheterize her. I found just within the external orifice a cicatricial narrowing the size of a catheter 2 millimeters in diameter, and yet the patient was conscious of nothing abnormal.

The treatment is one of gradual dilatations over a long period and repeated at intervals.

Incontinence.—There is no more distressing lesion than a urinary incontinence—a constant dribbling of the repulsive urine soaking the clothes which cling wet and cold to the thighs, making the patient offensive to herself and her family and ostracizing her from society.

Such an incontinence is found in traumatic or sclerotic lesions of the spinal cord, after unguarded dilatations of the urethra, as in boring in the index finger to examine the bladder or in the effort to drag a large stone out with forceps.

The commonest form is a result of childbirth, entailing an injury to the neck of the bladder; it is occasionally seen in elderly nulliparæ, and is commoner after forty years of age. It is usually progressive, beginning with an occasional dribble, later becoming more frequent and occurring on slight provocation. In its incipency, a strain or a cough, or sneezing or stepping up to get on a tramcar starts a little spurt of urine which in the course of time initiates the act which empties the bladder. One must also bear in mind the possibility of an incontinence due to a localized arteriosclerotic lesion in the lower cord, which is not relievably by operation.

The list of the operations devised to overcome the incontinence is legion; mostly unsuccessful, but occasionally, temporarily at least, affording some control; again, working harm by destroying tissue, or, as in the twisting operation, ending in an extensive slough.

The best plan, often successful, is to set free the thickened musculature (sphincter) at the neck of the bladder (Bell's muscle) and to suture it so as to overlap its ends, forming a good internal sphincter.

The patient is in the lithotomy position, slightly elevated; the posterior wall of the vagina is retracted, and the area at the neck of the bladder brought down by means of forceps or four tension sutures. A Pezzer catheter with a stem not over 5 millimeters in diameter is introduced into the bladder.

The next step consists in slitting the anterior vaginal wall in the median line for about 5 to 7 centimeters, down to the urethra and the bladder, the

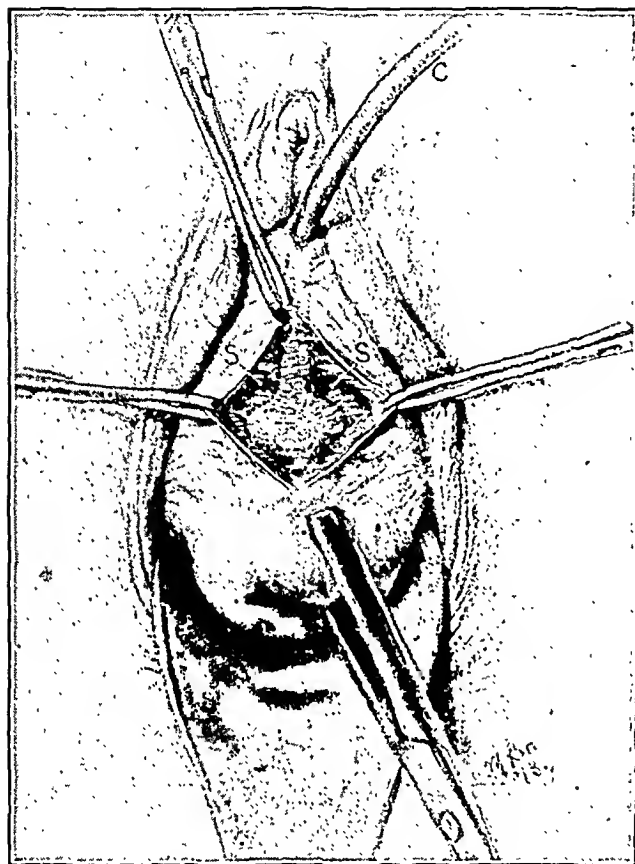


FIG. 668.—PEZZER CATHETER IN PLACE IN BLADDER DRAWN UP AGAINST INTERNAL URETHRAL ORIFICE, SHOWING LOCATION OF INTERNAL SPHINCTER SS.

Vagina laid open underneath this area or from cervix well down under urethra near to external orifice, affording full free access to all tissue lateral to neck of bladder.

neck of the bladder falling at about the center of the incision. The position of the bladder sphincter is easily determined by feeling the head of the catheter. Care should be taken not to cut into the urethra or the bladder. After making this median incision, the vagina is widely detached on both sides with tissue forceps and scalpel or a blunt dissector and dissected away for a distance of 2 to 2.5 centimeters on each side around the neck of the bladder, freeing at the same time the upper half of the urethra. This is done with blunt-pointed scissors pushing their way into the tissues. The dissection ought to be deepest at the vesical neck. As a rule, the bleeding is only moderate. With the detachment of vagina from bladder completed, the finger should be able to grasp about two-thirds of the neck of the bladder with its contiguous urethra. Sometimes the bladder is so thin in the

median line, due to the rupture of its muscle-fibers in labor, that the mucosa shines through.

The control is now secured by sewing together the torn or relaxed tissues at the vesical neck with two or three mattress-sutures of fine silk or linen passed from side to side: the first suture, turning in about 1.5 centimeter of tissue, is tied at once and left long to be used with care as a tractor; the next is applied on the outside of this, further contracting and drawing together the tissues at the neck. The mushroom catheter should be removed just before tying the first suture. The more or less redundant vaginal walls, which have

been detached in order to expose the sphincter area, are now resected so that the remaining tissues can be snugly brought together from side to side, thus supporting the vesical area operated upon and avoiding dead space between bladder and vagina, as well as making pressure upon the upper urethra somewhat constricting and supporting it. This suturing is best done with a continuous fine chromic gut suture in several layers. It is also often advisable to repair a relaxed posterior vaginal outlet, putting in a strong floor of support.

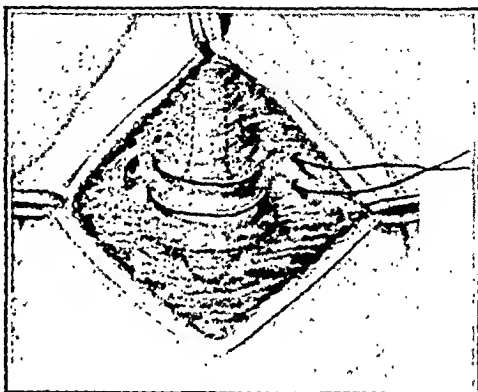


FIG. 669.—PERMANENT SUTURE, SILK OR LINEN, GRASPING DEEPER FIRM TISSUES ON EACH SIDE OF NECK OF BLADDER TO BRING SPHINCTER ENDS TOGETHER AS SHOWN IN FIGURE 670.

The postoperative treatment is simple. The patient should only be catheterized if imperative; there are those in whom catheterization must be done for several days or even for a week. The bladder must be kept free from residual urine. A Gatch bed with a half-way-up posture after operation is a great help.

Ischuria.—An isehuric patient sometimes without demonstrable cause is unable to void and the urine accumulates. It is seen in hysterical girls who may unwittingly cultivate the habit of being catheterized; again it is common in the puerperal state from the benumbing effect of the pressure of the head on the neck of the bladder. It is also seen when a large pelvic tumor, such as myoma, compresses the urethra.

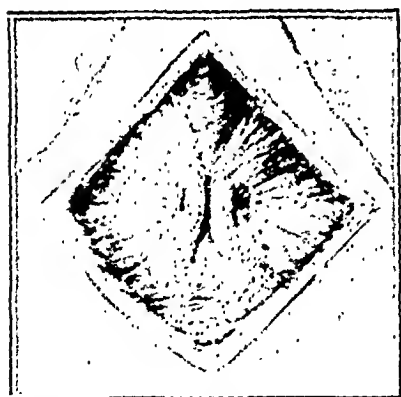


FIG. 670.—IT IS GENERALLY BEST TO TAKE CATHETER OUT BEFORE TYING SUTURE.

As a rule, another suture or two outside of and covering in the first is necessary. Also, the firmer tissues on each side of urethra can be drawn together with advantage to reconstruct a firmer posterior urethral wall without at any point opening the mucosa. This operation can be combined advantageously with that for cystocele.

The diagnosis is easy when a median lower abdominal tumor is found, and on introducing a catheter a large quantity of urine escapes and the tumor *pari passu* disappears.

The best treatment of a puerperal case is to have the patient urinate sitting up, and if this fails, to do a rapid dilatation of the urethra up to 12 millimeters diameter, or, that failing, catheterization several times daily or a permanent catheter for a few days.

The dilatation of the urethra, a bitter tonic containing nux vomica, and a dose of strong mental suggestion are best for the hysterical.

When a tumor presses on the urethra so as to obstruct it more or less completely, it is of paramount importance to remove it promptly and avoid any extensive sloughing which may even involve the entire vesical mucosa.

Chronic Urethritis.—There is a condition for which the term chronic urethritis is doubtless a misnomer but symptomatically seems to be the best designation.

The patient has painful urination, is extremely tender to touch, and, although no pus exudes at the external orifice, any manipulation with speculum or even gentle contact in any part of the urethra with a sound provokes a little hemorrhage. This tenderness is especially marked in the upper urethra and extends often into the bladder. The cause is obscure; it does not seem to be gonorrheal.

The best treatment is a thorough dilatation of the urethra under anesthetic with Hegar dilators up to 11 or 12 millimeters in diameter, followed by rest in bed for a few days. This dilatation is repeated at intervals of a week or so without anesthetic. Following the dilatation I inject a few drops of a weak silver solution (not over 1 per cent) daily with a medicine dropper.



FIG. 671.—GONORRHEAL ABSCESS IN TISSUES TO LEFT OF URETHRA CHOKING ORIFICE AND DISPLACING IT TO RIGHT WHILE PUSHING SKENE'S GLAND PROMINENTLY FORWARD.

Suburethral Abscess.—

There is an odd affection of the urethra called "suburethral abscess," "urethral urinary pocket," and "urethral diverticulum," whose essential is a pus pocket in the urethrovaginal septum which discharges by a slit in the posterior urethral wall. It forms a symmetrical rounded or ovoid swelling low down on the anterior vaginal wall, about 2 or 3 centimeters in diameter, looking like a urethrocele, sharply circumscribed, and visible in

the vaginal outlet. I saw one where it was well up near the neck of the bladder, which was recognized by an unusual cushiony resistance. The surface is painful, smooth, tense, elastic, or yielding; firm pressure diminishes its volume as the contained pus escapes into and out of the urethra. A urethroscopic examination shows a congested mucosa; on withdrawing the urethroscope some pus gushes into the specular lumen as it passes a certain point; this maneuver is repeated until the spot is fixed, and the longitudinal

fissure is seen. A probe passes into this and is felt in the sac in the vagina. Figures 671, 672, and 673.

Such patients often suffer for years and are treated for irritable bladder. They are usually married women in the thirties, complaining of painful micturition, excessive dyspareunia, and a sense of discomfort and bearing down. The patient herself may notice the discharge of pus, sometimes fetid, from the urethra.

With a catheter, clear urine flows from the bladder, and, as the catheter is withdrawn, pus from the sac.

The microscopic examination of the sac in a nulliparous colored woman, thirty-one years old, showed on the outer vaginal surface a typical mucous membrane, a connective tissue rich in oval and spindle cells with numerous dilated blood-vessels, and an inner lining of the sac consisting of mucous membrane eroded in places, beneath which were irregular aggregations of polynuclear leukocytes; the lining was rough with elevations and depressions. In some of the depressions, irregular oval cells with small oval nuclei were found, either in short rows or scattered without order, apparently urethral epithelium.

The sac is probably a urethral diverticulum resulting from an abscess in one of the urethral crypts in the posterior wall.

A wide distinction must be recognized between these sacs, with a small orifice of communication with the urethra, and a urethrocele—a bellying out of the entire posterior wall of the urethra.

It is a moot question whether trauma in labor with abrasion of the mucosa can form such a suburethral abscess.

Four plans of treatment have been followed:

1. A simple longitudinal, vaginal incision into the sac with a knife or cautery.
2. Excision of an elliptical piece of the urethrovaginal septum, including part of the sac wall, with or without suture.
3. Exsection of the entire sac and closure of the wound.
4. Opening and destruction of the sac lining with endothermy.

A simple plan conferring immediate relief is the first enumerated, by William Hey, in 1786, which avoids any risk of narrowing the urethra. This is readily done by benumbing the vaginal mucosa with a 2 per cent novocain solution and laying the sac open from end to end with a knife or preferably with the acusector of the endotherm. After cleansing the interior of the sac, it is a good plan to destroy its entire lining surface by electrodesiccation, leaving the wound to heal by granulation. In one instance, I split the vagina and



FIG. 672.—CONCEALED ABSCESS OF SKENE'S GLAND.

Drop of thick pus squeezed from right gland lies upon right labium urethræ. Orifice of left gland seen just inside left labium urethræ.

dissected out the entire sac with difficulty, on account of its intimate adhesions, and free bleeding. I completed the operation by closing the longitudinal wound in the posterior urethral wall with a series of fine interrupted silkworm gut sutures. The patient recovered nicely. In another where the union was

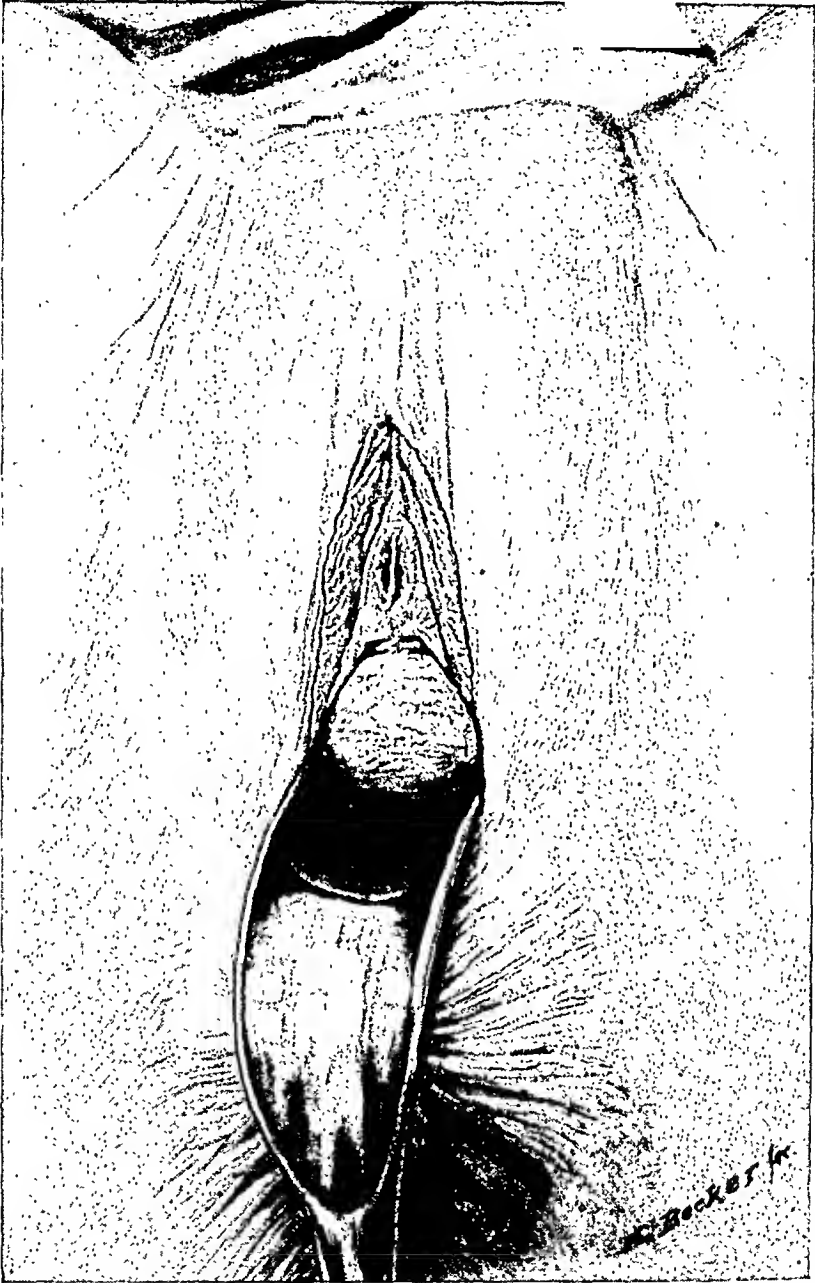


FIG. 673.—LARGE SUBURETHRAL ABSCESS OCCUPYING ANTERIOR VAGINAL WALL AND DISCHARGING PUS INTO URETHRA THROUGH NARROW SLIT NEAR INTERNAL URETHRAL ORIFICE.

delayed, leaving a urethrovaginal fistula, I closed the latter by a plastic operation.

New Growths.—The following new growths are found: Caruncle, carcinoma, sarcoma, fibroma—all rare. Caruncle is perhaps the commonest, cancer next, and sarcoma and fibroma but seldom.

Caruncle.—Urethral earuncle, or vascular tumor of the meatus, was described by Samuel Sharp in 1750 (*Critical Inquiry into the Present State of Surgery*, p. 168) who says, "Small excrecences may occasion violent disorders in so tender an organ as the urethra. I have seen a notable instance in the urethra of a virgin, where they grow in small quantity upon the orifice of the meatus urinarius, and for many months had produced the most excruciating torment, which continued until I finally extirpated them."

Almost in the same year, G. B. Morgagni wrote of a postmortem upon a girl fifteen years old, "Ex urethræ osculo corpusculum prominebat rubellum" ("De Sed. et Caus. Morb.," Lib IV, de morb. Chir., Venice, 1751).

Since this time English writers in particular have noted it.

The growth on the external orifice, somewhere on the lower half, is florid or dusky red and is attached to the urethral margin by a pedicle, or by a broad base, which may extend into the canal. The appearance varies, from flat and rugose and slightly elevated, looking like a raspberry, to a narrow tumor with a pedicle and a sharp, crenated edge, standing out from the urethra compressed by the nymphæ.

Histologically, one finds connective tissue and hypertrophied papillæ, with numerous dilated vessels. It is covered with pavement epithelium. The presence of any unusual number of nerve-fibers or any unusual arrangement of the nerve-endings has not yet been satisfactorily demonstrated. Sir J. Y. Simpson (*Clinical Lectures on Diseases of Women*) says, "The late Dr. John Reid once examined for me . . . a very sensitive and painful earuncle . . . and he came to the conclusion that there was a very rich distribution of nervous filaments in it."

The clinical history is striking. While some of them are painless, the majority cause exquisite pain during urination or contact. One of Simpson's patients suffered so that she was in the habit of going some distance to void, so that her moans and screams might not be heard. Another girl at puberty held her water for twelve hours at a time to escape the pain of passing it, looking forward with horror to the time when the urgency would become irresistible. In married women, the sexual relation becomes abhorrent. The wear and tear on the nervous system is so great that the health may be wrecked, and the patient spends her time in little else than nursing her misery.

William Goodell (*Lessons in Gynecology*, Philadelphia, 1879, p. 26) presents a typical extreme case. "A young married woman was broken down in mind and body by her sufferings. She was peevish, morose, and melancholic, and had dysmenorrhœa and every imaginable ache. Coitus had not been indulged in for months, and she had taken to her bed. Neither her medical attendant nor myself could believe that the presence of an urethral earuncle satisfactorily accounted for pale lips, hollow cheeks, sunken eyes, and for her grave mental and physical manifestations. . . . Yet after we removed the

caruncle she became another woman. As if by magic, all her pains and aches, even her dysmenorrhœa, left her."

When the growth is unusually vascular and its dilated vessels lie near the surface, hemorrhages are frequent and even alarming.

The diagnosis is readily obvious on separating the labia and touching the growth; if indeed the examiner can get near enough to the parts to investigate thoroughly.

The treatment looks to the immediate complete extirpation of the growth under anesthesia, preferably by electrodesiccation.

Carcinoma.—Cancer of the urethra belongs to the rarer diseases and appears in two forms, either primary, affecting, as a rule, at the outset, the exposed mucous surface of the urethra at its external orifice, or secondary as a metastatic periurethral cancer.

T. G. Thomas (*Am. J. Obst.*, 1877, 10) exhibited a cancer of the urethra of a patient, twenty-nine years old, who two months previously had noticed a pinkish discharge from the vagina, increasing almost to a hemorrhage. A physician found a tumor as large as an English walnut projecting from the urethra, which was removed with the entire urethra up to the neck of the bladder. It proved to be a carcinoma. Recovery followed with control of the bladder function.

In 1869, Melchiori and Riberi described five cases of periurethral cancer (*Schmidt's Jahrb.*, 146) starting in the vestibule near the urethra and developing in the cellular tissue without affecting the mucosa. The nodules were hard, showed no signs of ulcerating at first, and were the source of a lancinating pain. Later they ulcerated and bled.

I have seen two cases of secondary periurethral cancer. In both, the urethra was converted into a contracted rigid tube, bleeding when catheterized; urination was extremely difficult. In one, the disease extended from a labium majus down over the vestibule and around the urethra. In the other, a small-celled cancer extended from the vaginal vault down around the urethra following an extirpation of the uterus and upper vagina for cancer; the patient returned in six months with a nodular infiltration of the rest of the vagina and a hard infiltration underlying the whole urethral tract.

The only treatment for such a carcinoma as for that of the orificial mucosa is radium (see Chapter XLIV).

Sarcoma.—Sarcoma of the orifice is rare.

H. Beigel (*Die Krankheit des weiblichen Geschlechtes*, Stuttgart, 1875, Bd. II, p. 654) cites a sarcoma in a patient, fifty years old, with pain and hemorrhages from a tumor in three vertical folds at the urethral orifice about the size of a walnut. The tumor was removed with scissors with only moderate bleeding.

E. Ehrendorfer describes (*Centralbl. f. Gynäk.*, 1892, No. 17, p. 321) a patient fifty-two years old, past the climacteric, who for eighteen months had



PLATE XI.—CARUNCLE OF URETHRA.

A bright red cocksecomb growth springs from margin of urethral orifice, flattened by constant lateral pressure between labia.

noticed an enlargement which gave no trouble until about the time of the examination. Her attention was drawn to the swelling by an odorless, bloody, watery discharge. She bled, as in Beigel's case, at coitus. The tumor, projecting out on to the vulva, pushing aside labia majora and minora, consisted of several deep, red, injected, rounded, and cockscomblike protuberances, divided by deep sagittal fissures, with loss of the superficial epithelium and a bloody discharge. The attachment to the moderately resistant and elastic growth was mainly to the inferior lateral margin of the urethral orifice. It was removed without an anesthetic by pulling it forward and dividing the mucosa behind the pedicle on all sides. There was moderate bleeding and but one vessel was tied. The urethral and vaginal mucosa were united with catgut. Microscopic examination showed that the tumor was a small, round-celled sarcoma, resembling granulation tissue.

Galabin (*Tr. Obst. Soc. Lond.*, 38) also reports a "myxosarcoma of the urethra in a child" three years old, which pushed out between the labia, from a dilated urethra, and measured about 3 inches in diameter; its surface was bright red and lobulated. On removing it with the galvanocautery, the urethra was large enough for the introduction of a finger. The child died shortly after leaving the hospital. It was a round-celled sarcoma, myxomatous in places. The treatment which offers a substantial hope is thorough radiation.

A melanosarcoma in a single woman of sixty-four years is reported by C. A. L. Reed, of Cincinnati (*Am. J. Obst.*, Dec., 1896, p. 864).

The patient had discovered the tumor some months before and had had a more or less constant pinkish discharge. The examination disclosed a black, lobulated, eroded mass about 3 centimeters in diameter, separating the labia with the urethra in its center.

Almost the entire urethra was extirpated with the growth and she remained continent, dying over six months later with a large nodular abdominal tumor. Microscopically, it was a typical melanosarcoma.

Fibroma.—Buettnier describes a myoma of the urethra from Ahlfeld's clinic (*Ztschr. f. Geburtsh. u. Gynäk.*, 1894, 28). The patient was forty years old and her only difficulty from the ulcerated mass, 5 centimeters in diameter, was in voiding, the urine escaping drop by drop. The origin of the tumor was immediately above the crescentic external urethral orifice which was 4 or 5 centimeters wide. The diagnosis was a probable connective-tissue tumor. The enucleation was easy, the tumor slipping out of its bed like a uterine fibroid. The bleeding was slight, and the wound was drained; the patient recovered with entire control. Histologically, the growth had evidently originated in the smooth muscle-fiber of the urethra.

H. G. Wetherill (*Am. J. Obst.*, 1901, 43) figures an instance in a woman of forty-six, unmarried, tired, unable to walk, much annoyed by her vesical irritability, and complaining of a protrusion in the vulva for some years which had been labeled an "inoperable prolapse of the bladder." The edematous

mass was about 5 by 9 centimeters, eroded in patches, and held within the vagina with a pack and a T-bandage. The urethra traversed it near its upper border. At the operation, it was found firm and fibrous and easily enucleated, except in its anterior portion where it enveloped about 4 centimeters of the elongated urethra. The dissection was extremely careful, sparing the sub-mucous layers; the wound was sutured with fine catgut. Recovery took place with imperfect control through loss of the muscular tissues extending up to the neck of the bladder. A pessary was fitted so perfectly that control of the bladder was restored when further surgical attention was refused.

Cyst.—Cysts of the urethra occur rarely from childhood on.

DISEASES OF THE BLADDER

Diseases of the bladder originate in some part of the bladder walls, and are connected with its functional activity, or arise from an extension of disease from some other organ.

Any disease originating in the bladder first involves one of its component layers, either the mucous, the muscular, or the fibrous. The list of such local affections is short; we have, for example, papillomata, tuberculosis, inflammation of the mucosa, or myoma and fibroma of the muscular and fibrous layers. The physiological activities of the bladder as a urinary receptacle and the efficient agent in the intermittent expulsion of the urine render it peculiarly sensitive either to renal and ureteral infections, transmitted stones, or the implantation of tumors derived from the kidneys.

Stones are formed from nuclei either transferred from the kidney or originating above the bladder. The bladder is also often inoculated by bacilli from a tuberculous kidney. When there is an obstruction to the overflow of the urine, the bladder walls become either abnormally thin or greatly thickened.

The topographical relations of the bladder, its continuity and contiguity with neighboring structures, are a fruitful source of secondary affections. A conspicuous example is the cystitis following a gonorrheal urethritis. The peritoneal covering is also often involved in pelvic peritonitis, when the bladder forms adhesions to the uterus, to ovarian and tubal tumors, and even to the rectum. One often sees adhesions between the bowel and bladder so extensive as to bury the uterus.

The bladder is also liable to participate in vaginal, uterine, tubal, and ovarian affections. As each of these organs has a tendency toward certain diseases, and lies in contact with but a limited area of the bladder, certain vesical regions are thus more susceptible to sundry particular affections. The outstanding example is the fistulous communication between vagina and vesical floor. Again, the area of the bladder touching the cervix is liable to invasion by a cervical cancerous disease; ovarian and tubal abscesses break through the broad ligament into the bladder posteriorly near the vesical cornua.

A diagnosis is made by taking a careful history with symptomatology, by urinalysis, by a direct examination, by palpation, and by inspection of every part of the illuminated inner surface under simple atmospheric distention, as described.

With these methods of diagnosis we can at once differentiate simple from grave cases and localized from diffuse affections, and rational plans of treatment can be adopted. Bits of tissue can be taken for diagnosis and topical applications can be made under direct inspection.

Vesical diseases are congenital, displacements, foreign bodies, fistulas, inflammations, and neoplasms benign and malignant.

CONGENITAL

Congenital defects are not common; they are loculate bladder and exstrophy.

Loculate Bladder.—Congenital loeuli or diverticula forming small or large pockets as seen from within are not rare, and are due to a defect in the muscular wall. Pockets also form in cystitis from the straining in urination; they are far commoner in men. When large, they were formerly rated as supernumerary bladders; A. Molinetti, in his *Dissertationes Anatomico-Pathologicae*, describes a woman with five urinary bladders. G. Blasius, too, mistook one such for a double bladder. In 1670, he examined a man of thirty whose bladder just back of the urethra corresponded in all respects to a natural organ, but in its upper part, communicating by an extremely fine opening, was found a second bladder of less capacity.

I have seen many loculate bladders in cystoscopic examinations. In one, there was an opening in the right wall 1 centimeter in diameter into a cavity 1 centimeter in depth, situated above and posterior to the ureteral orifice and near enough to it to be mistaken for a large ureteral opening. While under observation the bladder contracted rhythmically, throwing the mucosa into numerous folds, and with each contraction the oval diverticular opening became narrower until nothing appeared but a fine line with lines radiating out into the surrounding mucosa.

A trabeculate, loculate bladder becomes important only when there is a cystitis and the infection lodges in the pits, or when a stone is trapped there.

Exstrophy of Bladder.—Exstrophy, or eversion of the bladder, from a fissure or defect in its anterior wall, is commoner in the male and is due to a defect in the lower abdominal laminae dating from early fetal life.

Lesser degrees are found in a superficial furrow in the lower abdominal wall, splitting the clitoris into right and left and separating the labia. A narrow furrow over the symphysis, extending up over the anterior abdominal wall to the umbilicus, is an indication of a fissure just avoided. The failure of the urachus to close above leaves a vesico-umbilical fistula, through which the urine escapes; again, instead of a fistula, we may have a fissure into the

upper part of the bladder, exposing its mucosa, when the defect is yet more extensive and the fissure lower down; in extreme cases the entire anterior bladder wall is lacking. When the fissure involves the whole anterior wall of the bladder, the symphysis pubis is also wanting, and the pubic rami are joined by a fibrous band from 1 to 8 centimeters long. The



FIG. 674.—DIVERTICULUM IN BISMUTH INJECTED BLADDER SHOWN BY X-RAY.

navel is displaced downward, and often there is no other evidence of its existence than a broad smooth scar. The recti are widely separated, and only a thin membrane between them protects the abdominal cavity. Low in the pubic region the whole extruded bladder, looking like a spongy fleshy mass, appears over the position of the vaginal orifice, the size of a walnut or a fist, in color varying from pale rose to dark red. The surface is irregular and

wrinkled, or granular and indurated in patches. The parts are covered with slime and malodorous urine. In children the sensitiveness is extreme. The ureters appear upon the surface of this mass between the mucous folds or at

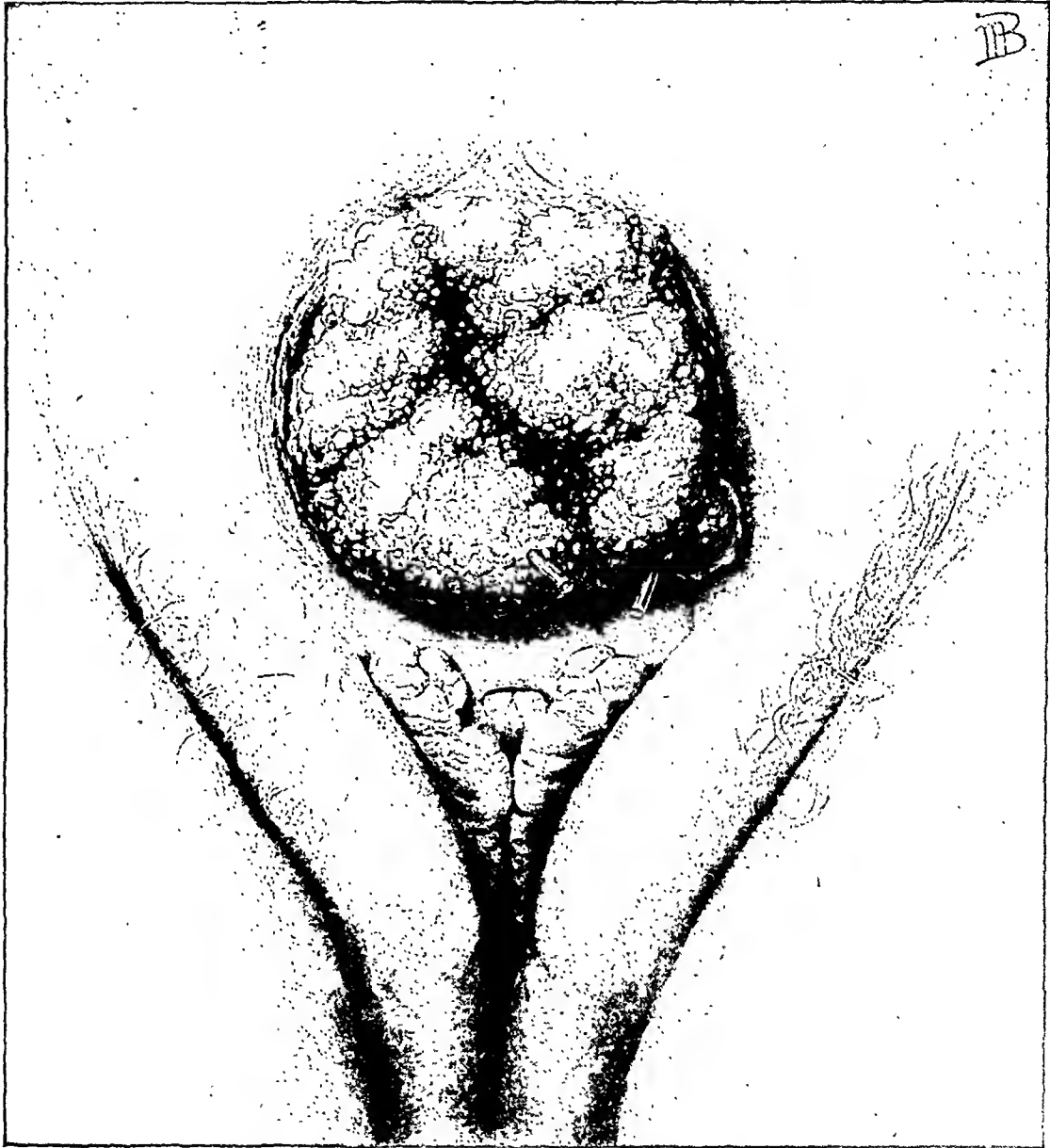


FIG. 675.—EXSTROPHY OF BLADDER CONVERTED INTO CARCINOMATOUS MASS.

Catheters mark ureteral orifices. Labia majora widely separated and covered with sparse hairs; between labia and below bladder lie separated halves of clitoris, with divided nymphæ to right and left. Vaginal orifice marked by transverse slit between halves of clitoris. $\times \frac{5}{8}$.

the apex of a papillary elevation, discharging jets of urine at intervals, projecting it even a foot from the body. It is best not to sound the ureters and risk an infection, easily proving fatal. In girls the urethra is generally wanting. The genital tract may be normal or there may also be a vaginal

atresia with incomplete development above. Many, otherwise malformed and puny, die early; others attain old age; pregnancy has occurred.

C. C. T. Litzman (*Arch. f. Gynæk.*, 5) and A. Gusserow (*Berl. klin. Wchnschr.*, 1879, No. 2) have studied with special care the abnormal mechanism of labor, with separated symphysis and without the *vis a tergo* of the abdominal pressure. Gusserow extracted a dead child in foot presentation as the mother was unable to complete labor.

An exstrophied bladder may become carcinomatous from the constant irritation of its surfaces, Figure 675.

Success in the treatment of exstrophy varies with the extent and position of the defect. In the rare case with an opening high up and unaccompanied

by a defect in the genitals and lower urinary apparatus, a cure may be effected by making a funnel-shaped denudation around the orifice, with a side-to-side approximation with fine chromic gut or silkworm gut sutures. Where the defect is extensive and the urethra absent, a plastic cure is a lusus. It is then best to open the abdomen and anastomose the ureters into the sigmoid flexure about on a level with the pelvic brim.

Where there is a complete dehiscence of the anterior vesical wall with the attendant eversion, the condition of the patient is pitiable in the extreme, worse even than an extensive vesicovaginal fistula with its continuous malodorous

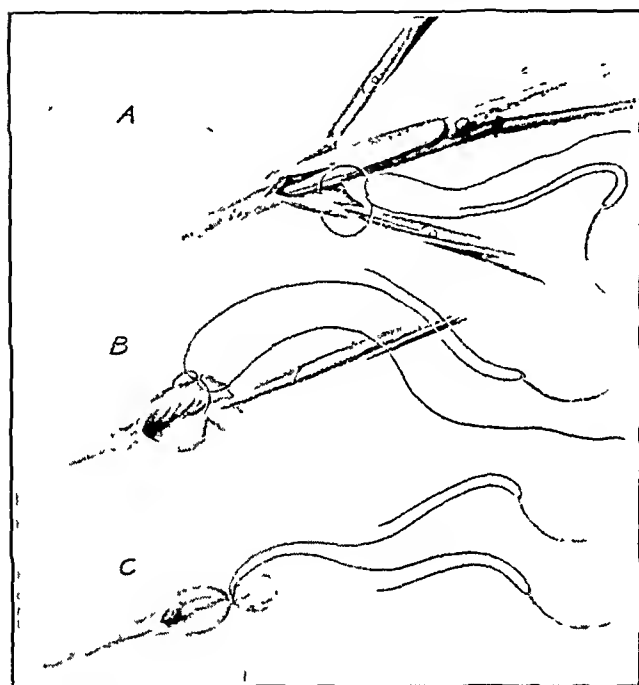


FIG. 676.—PREPARING URETER FOR IMPLANTATION.

A. Ureter severed and freed, end being slit open. Silk thread passed through half of duct and tied. B. Other half of duct being tied. C. Both ends of sutures threaded into needles ready to be drawn into the bowel and tied well below the point of entrance. (R. C. Coffey.)

discharges and eczematous madid tender skin and encrusted hairs. The often exquisitely sensitive, everted vesical mucosa adds the last straw to the unbearable stigmata of this distressing malady. If, therefore, in any possible way relief is obtainable for a fair percentage, the effort would seem justifiable even in the face of considerable risk.

Two principles are desirable in an operation. One, a reservoir to act as a substitute for the urinary bladder; two, the removal of the offending vesical mucosa in case the ureters are diverted into a new channel.

Usually the patient has a normal, tight rectal sphincter which justifies

using the rectum as the reservoir, as shown by repeated experiences with ever increasing success. The operation is best done when the child is six or eight years old, and can coöperate in training the new function by visiting the toilet at intervals of a few hours and by rising once or twice at night. One of the pioneer successful operations was that of G. R. Fowler, of Brooklyn (*Am. J. M. Sc.*, 1898, 115) on a boy six years old, followed to adult life.

R. C. Coffey's method (*Am. J. Obst.*, 1911, 56; *Surg., Gynec., & Obst.*, 1921; *Northwest Med.*, 1925, 24) to-day supersedes all others as based on better principles, established experimentally, and tested repeatedly.

The procedure consists in an implantation of the ureters into the lower sigmoid flexure or upper rectum, obliquely through the coats of the bowel, entering the lumen through a small orifice at the lower end, the object being to secure the advantage of a pressure closure of the ureteral lumen as the

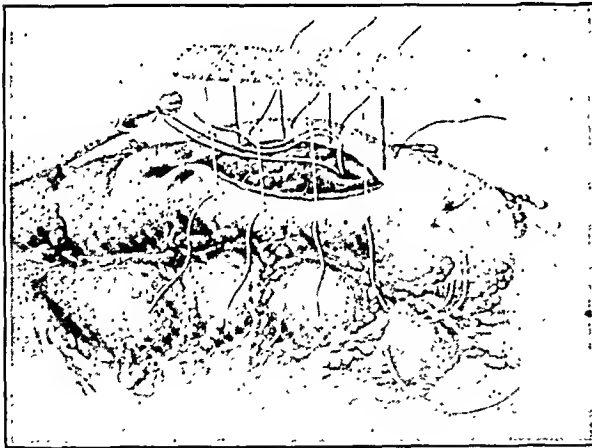


FIG. 678.—SUTURES PASSED AND URETER BEING DRAWN DOWN UNDER INTESTINAL SUTURES THROUGH STAB WOUND IN MUCOUS MEMBRANE. (R. C. Coffey.)

bowel exercises its function. When the ureters are implanted separately, the right is inserted first and after complete recovery the left follows. The method of implantation is a median or lateral incision, exposing bowel and ureter, the bowel having been thoroughly emptied. The ureter is located at the pelvic brim where it is often found passing in direct trajectory to the bladder without a pelvic dip, easily detached for about 4 centimeters, and handled with the utmost care to avoid in-

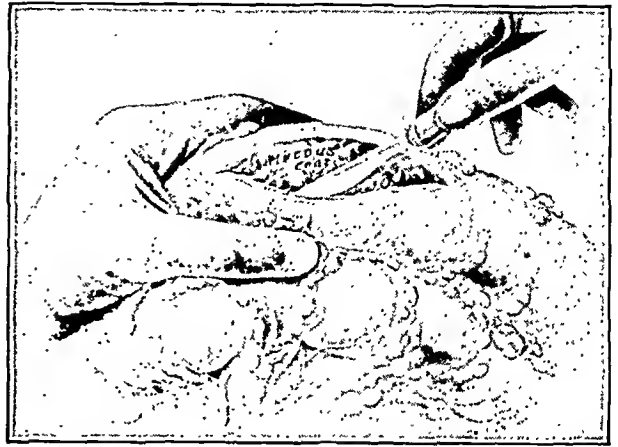


FIG. 677.—INCISING PERITONEAL AND MUSCULAR COATS OF INTESTINE AND FREEING MUCOUS MEMBRANE FROM MUSCULAR COAT. (R. C. Coffey.)

juring its vascular investiture. It is tied off below, divided, and the lower end dropped. The upper end is slit and caught by a fine silk ligature, Figure 676. The bowel is then prepared for the embedding of the ureter by a longitudinal incision of about 4 centimeters down to its mucosa. Sutures are passed to close this incision as soon as the ureter has been implanted. A little puncture of the

mucosa is made at the lower end and the free end of the ureter drawn into the bowel and fastened. For this part of the operation, C. H. Mayo isolates the bowel and passes sutures in between those indicated, catching lightly the external coats of the ureter, fixing it in its bed. Two rows of sutures complete the embedding. Owing to the swelling of the intestine, the ureter cannot function

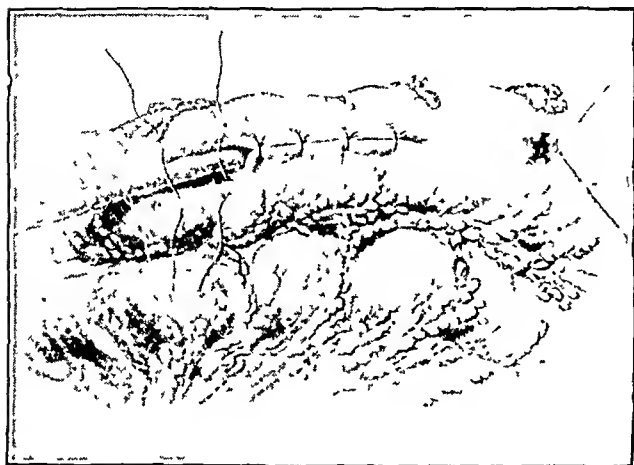


FIG. 679.—DUCT IMPLANTED AND ANCHORED AT ITS END INSIDE INTESTINE BY TRACTION SUTURE.

Part of intestinal sutures tied. Small anchor sutures fasten ureter to peritoneum of intestine. Two intestinal sutures remain to be tied over anchor suture. Traction suture to right being covered in by purse-string suture. (R. C. Coffey.)

rectal catheter is withdrawn, pulling the ureteral catheters with it, until these appear well outside of the body and the ureters are snugly lodged as shown; finally, the muscularis of the bowel is united over each ureter so as to imbed it obliquely as described.

The urine now flows continuously and without contamination direct through the ureteral catheters into a suitable vessel at the bedside. The tubes come away in about a week, when the intestinal swelling has subsided, and the implantation is complete. The avoidance of two operations is of great advantage to the patient, particularly when there is carcinoma of the exposed mucosa of the bladder.

Such an operation can be readily concluded by the complete destruction of the mucosa of the bladder with the high frequency coagulation current.

DISPLACEMENTS AND ALTERATIONS

The bladder is liable to remarkable displacements and alterations of form in its effort to carry out the function of a urinary reservoir in spite of various hindrances, due to its resemblance to a lax bag which readily adapts its form by the water pressure within to the varying available space. It is pulled up to the umbilicus by a large fibroid tumor, or squeezed out of the pelvis by an

for some days, making it inadvisable to implant both ureters in this way at one sitting. This difficulty Coffey has overcome by the procedure demonstrated in Figures 680 and 681.

This latter method depends upon the insertion of a rubber tube up through the anal orifice and empty bowel as far as the upper implantation. Fine catheters are passed up the ureters in the direction of the kidney and tied in each amputated ureter. The lower end of each ureteral catheter is attached to the rubber tube in the rectum through the little opening in the bowel; the

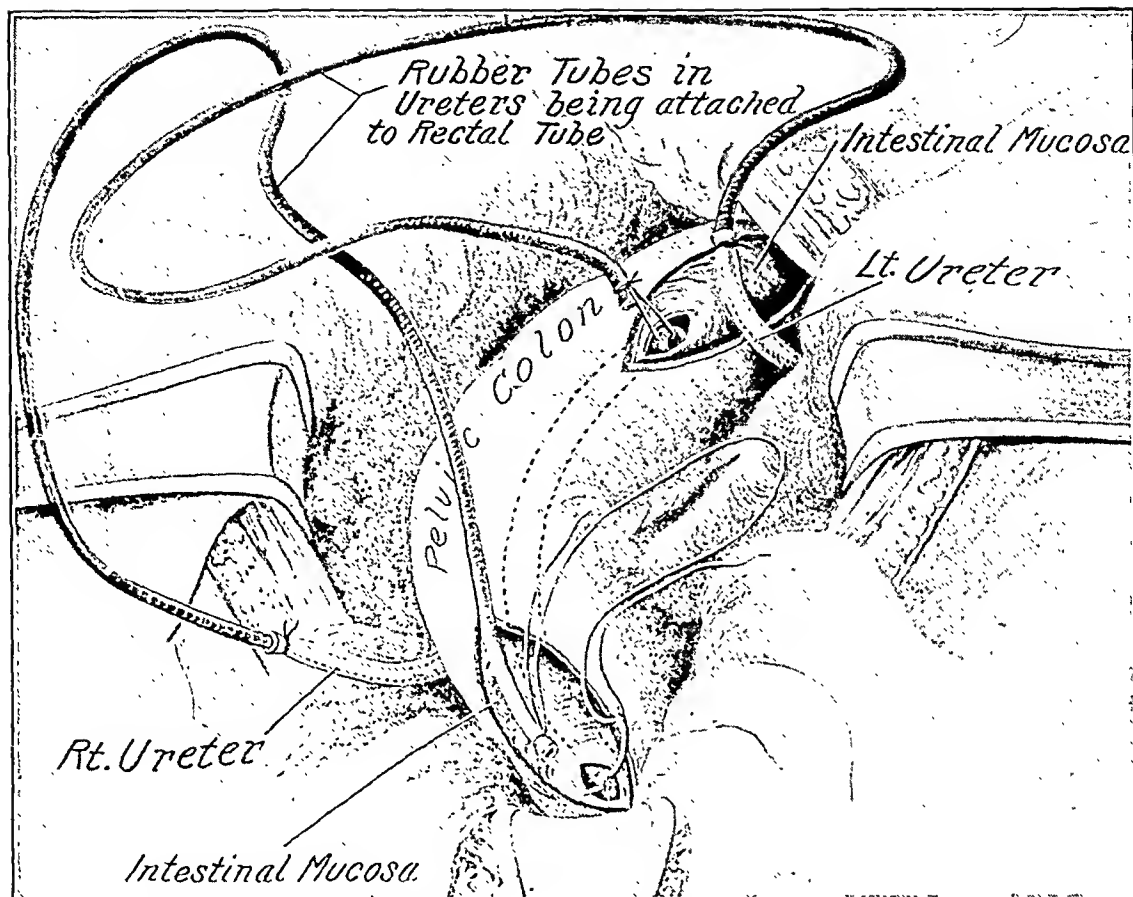


FIG. 680.—SIMULTANEOUS IMPLANTATION OF RIGHT AND LEFT URETERS.

Both ureters severed and long rubber tubes fastened in them for temporary drainage of kidneys. Tubes shown being attached to rectal tube in bowel by which ends of small tubes are drawn out through the anus and placed in container. End of ureter will be drawn down and implanted in intestinal wall outside mucosa. (R. C. Coffey.)

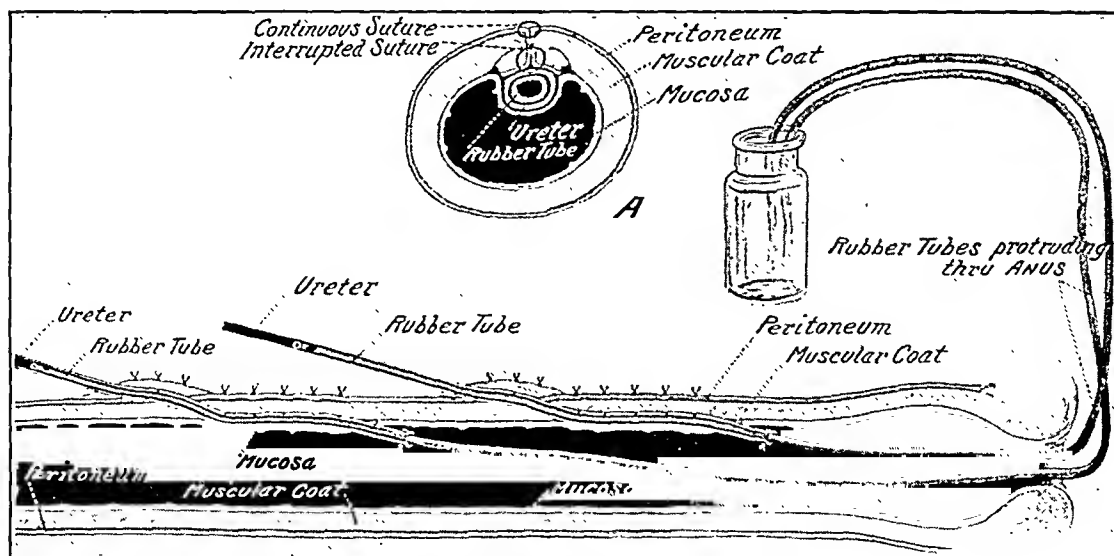


FIG. 681.—DIAGRAMS OF BILATERAL IMPLANTATIONS OF URETERS INTO PELVIC COLON.

A. Cross section of intestine at site of a ureteral implantation. Below: Longitudinal section of pelvic colon into which both ureters have been implanted at one sitting. (R. C. Coffey.)

ovarian cyst, or, again, a mass of pelvic adhesions forces it to expand downward in the direction of a broken-down vaginal outlet. If the upward displacements are not borne in mind, it runs a great risk of being cut into on opening the abdomen.

The displacement of a part, rarely of the whole, bladder, is found in prolapsus uteri. The partial extrusion often takes an hourglass shape, and accumulates foul urine and even calculi in the lower part. When the ureters are thus compressed and dilated, an infection may spread upward and cause death.

A common lesser degree of displacement is that of the familiar cystocele due to a breaking down in the fascial supports or pillars of the vesical base in multiparæ.

Intrapelvic lateral displacements are common when the opposite posterior quadrant is filled with a tubal or ovarian tumor.

A vesical diverticulum is found in inguinal and femoral hernias and must be borne in mind in operating.

A diagnosis of these displacements is easy if the formation of a tumor varying in size is noted and a sound is passed by the urethra and used to make a careful exploration of the bladder cavity. By injecting the bladder with a bismuth emulsion, excellent graphic x-ray records can be secured representing all phases of displacements.

The displacements cited are passive, and the treatment is that of the causal condition; when this is removed the trouble is cured. Cystocele is treated by restoring the inferior supports (Chapter XIX).

FOREIGN BODIES

A variety of foreign bodies are found forming in the bladder itself, as in the case of many phosphatic and uratic vesical calculi which are thus endogenous, as it were, or an oxalic or uric acid calculus may descend from the kidney via a ureter and lodge in the bladder, where it continues to grow by accretion from the urinary salts, or a foreign body may be introduced *per urethram*.

Foreign bodies also penetrate from the peritoneal side, such as a pin from the appendix, or echinococci, or a ligature from the pedicle of an ovarian tumor; dermoid cysts open into and discharge hair through the bladder (pilimic-tion); and the bones of an extra-uterine fetus have repeatedly found an exit by this avenue. The commonest foreign body entering from the vaginal side is a pessary, which ulcerates through the septum.

By the urethra odd longish instruments have been introduced manually, the commonest object being a broken off catheter or an entire glass catheter which has slipped out of the fingers. Articles introduced by the patient herself are hairpins, toothpicks, crochet needles, and what not.

The first symptoms are irritation of the bladder, followed by a cystitis, with

suprapubic pain, the frequency and passage of cloudy urine, and pus. The foreign body soon becomes incrustated, and the cystitis increasingly urgent. Elongate bodies are apt to ulcerate through into the vagina, or even into the peritoneum causing a rapidly fatal peritonitis.

The diagnosis is easy enough when the patient confesses the introduction of the foreign body. A large stone can often be felt bimanually. The nature

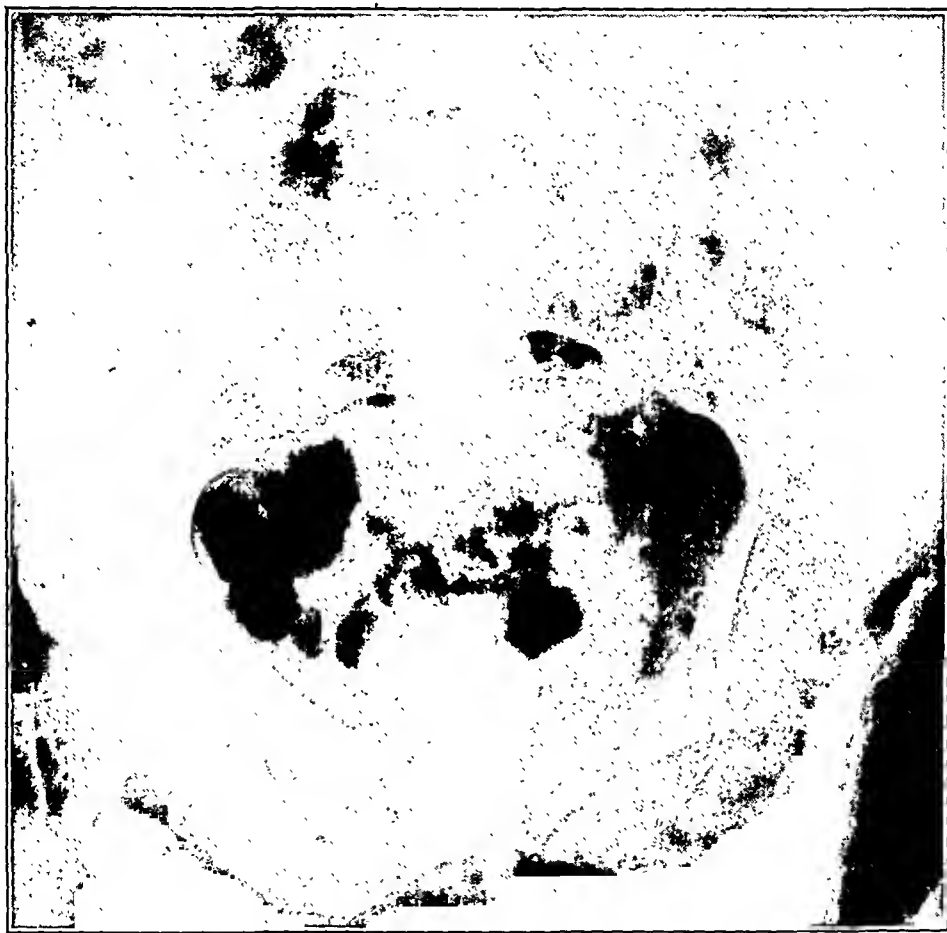


FIG. 682.—STONE IN BLADDER SHOWN BY X-RAY.

of the trouble is, however, always immediately made clear by one look through the cystoscope which is always imperative. The click of the sound striking the foreign body is sometimes the note which clarifies the diagnosis. An x-ray always yields an admirable record of glass, stones, and metal objects.

Figure 683 is of a vesical calculus seen in the air-distended bladder through the open cystoscope illuminated by the reflected light of the head mirror. There was history of a severe cystitis after labor, the infection apparently originating in the traumatism of the head crushing the bladder walls against the unsuspected stone. The operation was followed by a prompt and permanent cure.

The treatment is to remove the foreign body as soon as possible, either (1) through the urethra, (2) through a vaginal incision, (3) or through a suprapubic incision.

1. If the foreign body is small, not over 10 or 12 millimeters in diameter, or if it is long and narrow like a needle or a glass catheter, it can always be removed through the examining vesical speculum. The plan is to dilate the urethra up to 12 millimeters and introduce the speculum in the knee-chest posture. If the object is small and round, it is then at once picked up by an alligator forceps and simply extracted, or it can be caught with a scoop, pressed against the end of the speculum, and withdrawn with it.



FIG. 683.—VESICAL CALCULUS, SEEN THROUGH SPECULUM. $\times \frac{2}{3}$.

A longish body like a glass catheter is removed by introducing a straight instrument, such as a searcher, into the open end, and then manipulating the end of the speculum until the foreign body slips into

it; then by pushing the speculum well down on the catheter engaged in this way, its end can be easily caught and withdrawn together with the speculum. Soft stones can be crushed through the open speculum and the larger pieces lifted out while the smaller ones are flushed out by irrigation in the dorsal posture. It is usually well to give an anesthetic if the operation cannot be done with the utmost ease.



FIG. 684.—REMOVAL OF CALCULUS THROUGH VAGINAL INCISION MADE FROM CERVIX UTERI TO TRIGONUM. $\times 1$.

I removed a glass catheter in this way from a young woman with a myomatous uterus which filled the pelvis and reached up to the umbilicus. She had retention of urine, and her physician let

his glass catheter 13 millimeters long slip in the overdistended bladder. I could feel the myoma with a long rigid body lying in front of it, with one end pressing on the anterior vaginal wall and the other up near the umbilicus. By careful bimanual manipulation, I pushed the upper end to the right, and the lower end

up so as to bring it into the urethra, where it emerged at the external orifice with a lot of bloody urine.

Most stones can be crushed readily with a lithotrite in a bladder moderately distended with water, when the pieces can be removed through the speculum in the knee-chest posture.

2. Next to the simple methods just described, the vaginal incision is the best for stones too large to break and extract through the urethra.

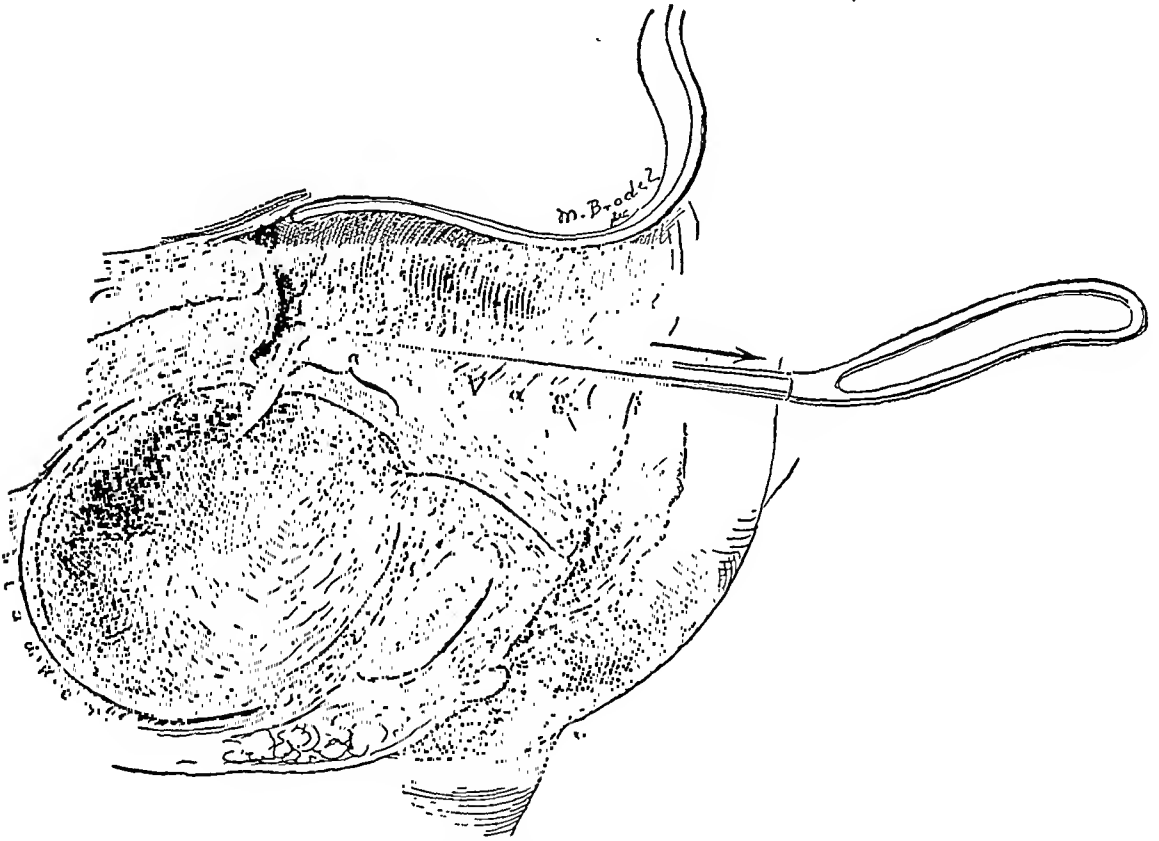


FIG. 685.—RAPID AND SAFE METHOD OF OPENING BASE OF BLADDER.

Patient in knee-chest posture. Speculum introduced to admit air into bladder. Air-distended organ then opened in manner demonstrated to extent indicated at *a*.

The operation can be done conveniently under local anesthesia with the patient in the left semiprone posture, with the posterior vaginal wall well retracted, exposing the entire anterior wall. A blunt instrument like a male sound is introduced into the bladder, distended with water, and the anterior vaginal wall pushed forward in the median line and cut through, opening the bladder; the edges of the incision are caught and held fast while the opening is extended with scissors up toward the cervix and cautiously forward toward the neck of the bladder which is guarded by introducing the index finger until the hole is large enough for the extraction of the stone grasped by its smaller diameter in a stone forceps, Figure 684.



FIG. 686.—PHOSPHATIC CALCULUS FORMED UPON HAIRPIN IN BLADDER.

Another, I think better, way is to put the patient in the knee-chest posture and let air into the bladder. Then retracting the posterior vaginal wall with a Sims speculum, exposing well the anterior wall, a two-edged knife blade, fixed at an angle on a long handle, is plunged through the tense septum and the opening enlarged fore and aft in the median line, Figure 685. A beginner should put a mushroom catheter in before operating, to protect the internal urethral orifice. The stone is then located and withdrawn with forceps. If there is much cystitis, the wound may be left to heal spontaneously, which it does quickly. A fairly clean bladder can be closed at once with a few catgut or silkworm gut sutures, taking in all layers down to the mucosa; then let the patient wear a drainage catheter for a few days, after which she should void her urine. A curious outcome of the habit of titillating the genitals with a homely instrument is seen in the hairpin calculus which I owe to the late F. R. Eccles, of London, Ontario; the hairpin es-

caped into the bladder and in time became heavily incrustated; married soon after, at her confinement a large foreign body was felt obstructing the descending head; when it was pushed up the labor proceeded normally. Eccles removed it later through the vaginal wall; the wound left open healed spontaneously within five weeks.

3. The suprapubic incision, the classic *sectio alta*, is best adapted to those large calculi which fill the bladder, and in children where the vaginal route is not available.

The bladder is distended with water, and a transverse or a vertical incision made about 8 centimeters long just above the symphysis; the recti and the pyramidales muscles are separated and the finger carried down through the loose cellular tissue to the full bladder, care being taken not to open the peritoneum. The bladder being exposed, the peritoneum is pushed well up, the vesical wall incised and the stone extracted. After clearing away the

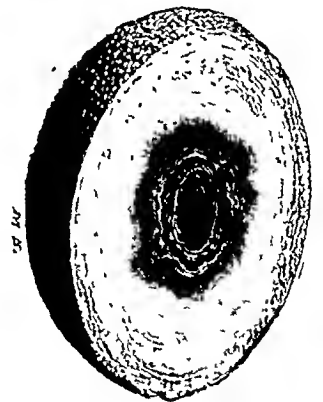


FIG. 687.—SECTION OF VESICAL CALCULUS OF BLADDER REMOVED FROM A GIRL EIGHT YEARS OLD. $\times 1$.

perivesical fat, take care not to dislodge the loose fascial investiture of the bladder, a valuable adjuvant in closing the wound with interrupted or with a continuous catgut suture embracing the entire thickness of the wall excepting the mucosa; the fascial envelope is sutured over this. The incision in the abdominal wall is then closed with silkworm gut or fine chromic gut, leaving a cigarette drain opening for four or five days. If the bladder is kept drained for a week with a mushroom catheter, the clean incision in the vertex ought to heal promptly.

The stone shown, Figure 687, was removed by the suprapubic operation from a girl eight years old, by F. R. Eccles.

VESICAL FISTULAS

Vesical fistulas, abdominal openings between the bladder and adjacent organs, are found between bladder and vagina, between bladder and uterus, and between bladder and the intestinal tract.

The natural tendency of a fistula is to close, rarely spontaneously and completely, by granulation and cicatrization with contraction of its margins. In this way, a small fistula may occasionally disappear in a few weeks, while a large one becomes greatly reduced. A clean-cut opening, such as that made to extract a stone, always closes without aid. In time the margins of the large obstetric fistulas grow sharp and hard, in bad cases the cicatrices radiating out on to the vaginal walls or pinning the opening down to a pubic ramus. Injuries to the lower vagina sometimes render the canal so rigid and contracted that it is extremely difficult if not impossible even to see the fistula. Destruction of the vaginal vault often carries with it the anterior lip of the cervix (fistula laqueatica), tying the bladder tightly up to the uterus above.

Although the tendency of a small fistula is toward spontaneous cure, a fine hair opening in the cicatricial tissue may persist for years. One patient had borne her fistula for twenty-three years, and the opening, almost invisible, was large enough to let all the urine escape.

Etiology.—The common cause is traumatism with ischemia from the impaction of the child's head in the pelvis, destroying the vitality of the tissues at the area of compression between head and symphysis; in a few days a slough forms, and shortly the plug of tissue drops out, leaving an opening large or small between the bladder and the vagina. Repeated pelvic measurements in these cases have demonstrated that the fistula following parturition is commonly in a contracted pelvis.

The prevailing impression that fistulas are due to the use of obstetric forceps is erroneous. T. A. Emmet long since demonstrated that they arise not from the use of the forceps but rather from delay in using them where urgently needed to prevent prolonged impaction with its disastrous sequelæ, as indeed was also urged by W. T. Schmidt in 1828.

They are also caused by such foreign bodies as stem-pessaries, working their way from the vagina into the bladder, or vice versa, Figure 688; syphilis; the extension of a cervical cancer; a fruitful peccant cause a few years back was a vaginal or an abdominal hysterectomy.

Symptomatology.—The symptoms are characteristic. Soon after the confinement, there may be bloody urine and difficulty in urination with cystitis and febrile disturbances; in a week or more the slough escapes, and the urine pours through the opening and out over the vulva, perineum, and adjacent parts which are kept soaked and malodorous. The effect on the skin is a

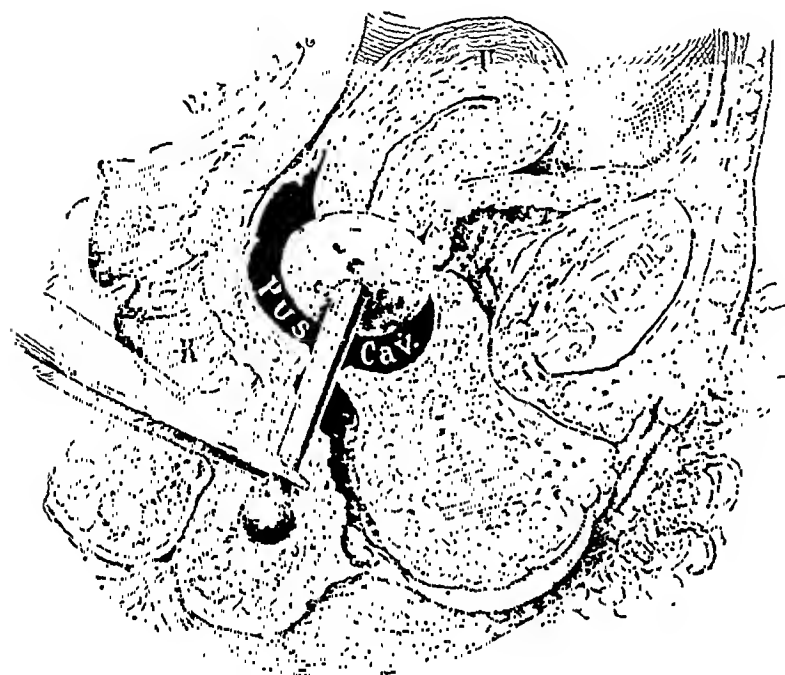


FIG. 688.—VESICOVAGINAL FISTULA CAUSED BY A PESSARY; SAGITTAL SECTION.

Shank of pessary buried in rectovaginal septum. Vagina atresic and pus cavity in upper portion discharges into bladder, which lies contracted behind symphysis, by a fistulous opening caused by cup of pessary. Hypertrophy of vesico- and urethro-vaginal septum shown.

part of the skin is a painful dermatitis and areas of excoriation; vulvar hairs are incrustated with the urine salts. Areas of excoriation are found within the vagina coated with a sabulous material and incrustations, while the parts are so exquisitely tender that the slightest movement is pain, and an examination impossible except under a profound anesthesia. These are some of the aforetime insuperable difficulties the genius of our immediate predecessors overcame with infinite never-flagging patience.

If the fistula is small, the patient in certain positions can often retain and void a considerable amount of urine. Also, if the vaginal outlet is not much damaged a considerable pool of urine may accumulate in the vagina while lying down to gush out on rising, leading to the erroneous idea that the bladder is continent. I saw one such patient who could retain 300 c.c.

The effect of the fistula on the general health is sometimes pronounced; the local discomforts root her like a vegetable in one place, enforce an almost solitary existence, precluding exercise, fresh air, and all social engagements; appetite fails, indigestion ensues with constipation, depression, and cachexia, and life becomes a weary burden, without even the solace of a clean bed at night.

In spite of all the seemingly insuperable obstacles, conception has occurred.

One of my patients with a fistula 1.5 centimeter in diameter near the neck of the bladder actually conceived and had a natural labor and puerperium, when the fistula was cured by operation.

A similar case of L. van Winckel's became pregnant and passed through her confinement, when the fistula healed spontaneously.

Diagnosis.—The diagnosis must include not only the fact of a fistula but all the associated conditions which complicate it: size, form, exact site, the condition of the surrounding vaginal walls—whether yielding or fixed by scar tissue, whether the anterior lip of the cervix is involved (cervico-vesicovaginal), whether it is anchored at any point, also whether accessible, and the mobility of the uterus. It is imperative to note the location of the ureteral orifices with reference to the edges of the opening. Other complications are the presence of two vesicovaginal fistulas, or a rectovaginal fistula.

Again, there is sometimes also a complete tear of the rectovaginal septum, and I have seen a large vesicovaginal fistula adhering to the pubic ramus, associated with a wide diastasis of the symphysis pubis ruptured in a bad forceps labor.

The history is that of a constant escape of urine, dating usually from a severe confinement or a hysterectomy; if in spite of having such a constant flow, she also passes water at regular intervals, the probable diagnosis is that of a ureteral and not a vesical fistula.

By touch the examiner discovers more or less vaginal scar tissue and the hole in the anterior vaginal wall, from which the urine escapes.

Inspection yields the fullest information when the posterior vaginal wall is retracted so as to expose the entire anterior wall where the fistulous opening is evident and can be studied in all its relationships; a small fistula may lie concealed in the vaginal folds, when not infrequently up near the vault and the cervix. A vesico-uterine fistula gives evidence of its presence by the urine escaping from the cervix.

A fistula which is not apparent can be located by injecting the bladder with an aniline solution or with sterilized milk and watching its escape. A fine sound introduced into the bladder by the urethra can usually be brought through the smallest fistula in the vagina.

The cystoscope is of use in examining the fistula from the vesical side, but is not so satisfactory as a vaginal view except in locating the ureters. Sometimes the best vaginal view is secured in the knee-chest posture through a conical metal speculum. If there is any doubt as to the participation of the ureter, both ureters should be catheterized; a fistulous ureter will block the catheter.

Treatment.—*General Principles.*—Preparatory treatment is imperative where the vagina contains sloughing necrotic tissue incrustated with salts, and the parts are raw and granulating; prolonged, repeated, warm boric acid vaginal douches and repeated painstaking cleansings of vagina and vulva to

wipe off sloughs and débris, followed by occasional applications of weak solutions of nitrate of silver to the raw surfaces, remove these complications. At the same time, bands of scar tissue can be incised, diminishing the tension on the margins.

If there is a rectovaginal fistula it should be healed before operating upon the vesicovaginal fistula, unless both can be closed at the same sitting. A recent fistulous area clears up more rapidly if copious saline enemata are given which pour out through the vagina and serve to keep the bowel empty.

Recent advances in treating bad fistulas dispense with some of the time-consuming, preparatory treatments for which our forefathers were justly celebrated, in the way of multiple incisions and the use of vaginal dilators, softening and promoting the absorption of scar tissue.

The best time to operate is within six or eight weeks after labor, while the tissues are still more soft, yielding, vascular, and free from fixation and the atrophy due to scar tissue. If the fistula is small and its edges can be easily drawn together with tenacula, they should be freshened and united by several fine silkworm gut sutures in the direction of least resistance; large and irregular fistulas are more difficult. The operation becomes most difficult with the formation of much scar tissue, and the attendant distortion. Pregnancy forms no contra-indication to operation, as shown by Schlesinger and others.

The important adjuvants to success are: Freedom from any marked or active inflammation in the bladder and the vagina; accessibility to the seat of operation, enabling the operator as nearly as possible to denude and suture as if the lesion were on the outside of the body; well vascularized tissues; a broad area of denudation; approximation of the denuded areas by sutures which will not absorb too rapidly; approximation without tension; placing the bladder at rest after the operation until union is secure. An operation awkwardly executed because of the distance and fixation of the tissues, almost invariably fails.

1. **Freedom from Infection.**—It is next to impossible to denude and get union in the presence of any lingering active inflammation. Preliminary treatments to restore tissues to a sound condition are repeated douchings, or, better, continuous vaginal irrigation for several hours daily, in a bed adjusted with a split mattress or a hole in the mattress so that a warm mild saline solution, or mildly antiseptic solution can be kept flowing over the affected parts by means of a nozzle introduced into the vagina. It is also well to curette away any sabulous material and to touch all raw areas with a 3 to 5 per cent solution of nitrate of silver, every two or three days.

2. **Accessibility.**—It is impossible to denude well and secure the necessary approximation if the fistula is distant and awkward to reach. Either the operator must go up to the fistula, or the fistula must be brought down to the operator, or both of these principles must be utilized. The nearer the fistula is brought to the outside of the body, the more likely is the operator to

succeed in each step of his task. Our forefathers, and especially Sims and Emmet, succeeded under conditions of extreme awkwardness where we to-day, with less of their special skill wrought out of an abundant experience, would fail lamentably. Like the bow of Ulysses there is scarcely one to-day who can handle their tools or use their legerdemain in this field; however, we can congratulate ourselves in the possession of methods and devices not available in their day, short cuts and bypaths over the rough road to success.

Accessibility is secured in the more difficult cases by one or two large posterior paravaginal incisions, which serve to place the operator almost directly over the field of operation by eliminating for the time being the vaginal canal.

The most valuable contribution here is the extensive colpotomy of the Schuchardt incision. For easy accessibility to uterus and parametria, no step equals Schuchardt's paravaginal incision, originally offered as a substitute for the sacral methods of extirpation of the uterus, which throws wide open the funnel formed by the levator anal muscle and the coccygeus through which the vagina passes as it emerges through the pelvic floor out on to the vulva (*Centralbl. f. Chir.*, 1893, 51).

With the patient in the lithotomy position, a long skin incision is made beginning between the posterior and middle third of the left labium majus and extending convexly outward down around the anal orifice at a distance of about 2.5 centimeters to end at the sacrum, a total length of from 18 to 20 centimeters. The vulvar incision is then carried on up the vagina which it divides completely to its attachment at the cervix, thus splitting the vagina for its entire length. The right half of the vagina with its associated soft parts, together with the rectum, now drops easily over to the right side, leaving a broad gaping wound, a sort of inverted funnel, in place of the narrow resistant canal. Douglas's culdesac is next opened and the parametria examined thoroughly on each side and divided at any desired distance from the cervix, thus greatly extending the field of operation in the desired right and left directions. The bladder and ureters are pushed up from the wound area and the ureters brought clearly into view and thus protected (Schauta).

Staude (*Centralbl. f. Gynäk.*, 1908, 37) further extended the Schuchardt preliminary operation by making another similar incision on the right and so reducing the percentage of the inoperables.

Again, if the uterus is mobile, the cervix can be caught and pulled down, displacing the fistula with it, or the vagina can often be drawn down by passing three or four silk traction sutures through its walls, say 1 centimeter from the fistula. When the fistula is pulled on and the scar tissue felt holding it, the latter can be relaxed by dividing it in one or more places. A ball of cotton, or rubber balloon with a hollow stem, pushed through the hole into the bladder and inflated and pulled on, sometimes helps the denudation and the suturing.

3. **Vascularization of Tissues.**—Tissues that bleed easily form good plastic material and unite readily. It is useless to denude and join dry tissues or ischemic scar tissue. For this reason the latter must always be excised liberally. Working in and with scar tissue is a cause of many failures.

4. **Area of Denudation.**—While it is important to sacrifice as little tissue as possible, it is still more important to make the area of denudation broad in order to get a snug wide apposition of well-vascularized surfaces.

One of the vital principles in the treatment of these fistulas which has really saved modern surgery just here, is the making of a satisfactory denudation in the majority of cases without the sacrifice of any tissue at all. This consists in the simple detachment of the bladder from the vagina, simply splitting them apart by running a sharp knife in between them on all sides of the fistulous orifice; in this way the bladder can be freed to any desired degree and even loosened so that it can be pulled down like a collapsed wet bag. After getting out beyond the scar tissue the dissection is made with a blunt instrument. In this way even though the ureters debouch on the margins they can be respected and liberated with the bladder and finally turned in as the loose tissues are sewed together. If the vagina is not lax enough to let its walls come together after closing the bladder, the raw surface can be left to close by granulation. While this method is of the utmost value in all fistulas, it is of permanent importance in the larger and complicated ones.

5. **Approximation.**—An important plastic principle is that the tissues come together readily and are adjusted without any marked tension. It is frequently difficult to observe this principle, but often parts assembled under some degree of tension are relieved when it is distributed over a number of sutures.

6. **Suture Material.**—Sims' silver wire sutures, carefully laid at suitable intervals and shouldered at the point of emergence in the vagina and then twisted so as ideally to splint the wound margins, were an admirable procedure. Our present day substitute is the impenetrable, resilient silkworm gut suture placed at sufficient intervals to carry the tension. I have also used fine flexible silver suture which is pulled up and twisted. Fine chromic gut does well for buried sutures as well as between the silkworm sutures. Silk and linen sutures are not so suitable for this work as they are apt to form setons conducting infection into the wound; if used at all, select a fine strong thread.

7. **Closure.**—Avoid wherever possible closing the wound by bringing several points together as in a V or an H. The best directions are represented by I — Z U or N.

8. **Placing Bladder at Rest.**—Placing the bladder at rest after the operation for from six to ten days, is usually essential. Once in a while when the tissues have been most satisfactorily approximated in a fistula of not more than medium size, it is safe to let the patient urinate from the first.

This is commonly done with a mushroom catheter introduced through the urethra. During the drainage period the bladder is irrigated daily, and the catheter is changed every three or four days. It must always be watched for a tendency to become choked with urinary salts. Sometimes it is well to drain by a catheter passed through a clean incision in the bladder back of the trigonum. When the catheter is removed, the incision closes of itself.

9. *P o s t u r e*.—The posture of the patient during the operation is extremely important. Almost without exception the lithotomy posture, sometimes exaggerated, is the most advantageous for the operator as well as convenient for assistants, with the vaginal orifice well retracted by a broad speculum and the field of operation displaced downward by one device or another as far as possible, in order to bring the fistulous orifice toward the outside and into the light of day, affording a maximum accessibility. The operation in this position has had its limits greatly extended by the Schuchardt incision which enables the operator to go up to the fistula when the latter is more or less fixed *in situ*, and not to be so dependent upon displacing the fistula downward.

The left lateral, or Sims semiprone posture, is occasionally convenient, but no longer used in the universal sense of its original promoters—Sims and Emmet.

If a fistula high up and fixed is attacked by the suprapubic route, an extreme Trendelenburg position makes the whole interior of the bladder easily accessible from within, as soon as the organ is opened.

10. *V a r i o u s A v e n u e s o f A p p r o a c h*.—Various avenues used in approach to a fistula are worth mentioning as they afford an interesting commentary on the resources of baffled human ingenuity.

(1) The usual and best is the natural channel; the external orifice of the vagina is always to be selected when possible. The use of any other than this must justify itself by some special conditions not remediable in this way.

(2) Where the scar tissue in the lower vagina prevents access, a transverse incision through the perineum has been used as an approach by M. Sanger, to obviate the difficulty by tunneling under it, as it were.

(3) Operators familiar with the advantages of the posterior parasacral operations on the rectum have recommended this avenue with the displacement of the rectum and a longitudinal opening in the posterior vaginal wall.

(4) A para-urethral incision through the vestibule loosens the fistula when tied to the pubic ramus. The difficulty here is the hemorrhage in tissues hard to control.

(5) The symphysis has been divided to effect this liberation of the fistula.

(6) Retzius's space can be opened above the symphysis in order to free the fistula, which is then closed by the vaginal route.

(7) The suprapubic transvesical (extraperitoneal) operation is sometimes valuable.

(8) Suprapubic transperitoneal detachment of the bladder from surrounding adhesions is used for fistulas high up and inaccessible from below.

(9) There is, also, suprapubic transperitoneal detachment of the bladder with the removal of the uterus and the adnexa.

The dangers of the operation are hemorrhage, control by efficient suturing, and the inclusion of one or both ureters in suturing, avoided only with sedulous care and by keeping in touch with the ureters all through the operation. A bad secondary hemorrhage may fill the bladder and cause the patient to burst the wound open in straining to empty it. Lives have been lost by the persistent bleeding.

11. *I n s t r u m e n t s*.—The instruments needed are: Sims specula, lateral retractors, tissue forceps, several artery forceps, a fistula knife, fistula scissors, tenacula, needles, needle holder, fine silkworm gut, chromic catgut, and fine silk.

Operation.—We shall consider the treatment specifically under the headings: Vesicovaginal, vesico-uterovaginal, vesico-uterine, enterovesical.

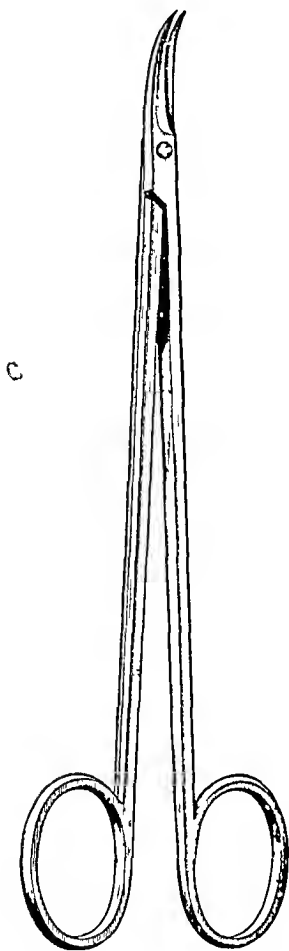
1. *Vesicovaginal*.—Expose the fistula by retracting the vaginal wall and draw it down by pulling on the cervix or the adjacent tissues transfixed with several sutures.

FIG. 689. — SCISSORS FOR PARING EDGES OF VESICOVAGINAL FISTULA.

Shanks are long and slender and blades are delicate and curved on flat. $\times \frac{2}{3}$.

(a) *Classical procedure*. First of all the edges of the fistula are pared on the vaginal surface entirely, creating a freshened area, 5, 6, or 8 millimeters wide, extending down to but not involving the vesical mucosa, using either knife or scissors. I generally prefer a delicate scissors, Figure 689. The freshening must extend out into the sound tissue, avoiding the error of merely paring a thin slice from a more or less vascular surface. Every particle of the tissue within the periphery of the opening is removed, and any discoverable islets of undressed tissue are picked up with a tenaculum and snipped off.

The direction of approximation with least resistance is ascertained as a guide in passing the sutures which are laid with an ordinary needle holder grasping a small curved, usually round needle, threaded with fine silkworm gut or fine silver wire or chromic gut. A tenaculum is helpful in steadying the tissues as the needle traverses them and in holding the point as it emerges until grasped by the needle holder.



The needle should pierce the vaginal mucosa about 3 millimeters from the margin of the denuded area and appear just under the vesical mucosa, to reënter the opposite side and emerge on the vaginal surface at a point corresponding to that of entrance. Other sutures are introduced about half a centimeter apart, until there are enough to close the wound snugly, taking especial care to secure accurate apposition at the ends of the wound or at an angle. It is helpful often to pass the first suture in the center, dividing the wound in two. The amount of tension in tying must be just enough to effect a snug union without blanching the tissues. Pass enough fine silk or linen to correct any pointing between the sutures.

It is well, if a ureteral orifice appears on the margin of the fistula, to slit it up into the bladder, or to dissect it up and turn it into the bladder before completing the denudation and closing the fistula.

When the fistula is pinned to a pubic bone, I sometimes introduce a long delicate tenotomy knife on the vulvar surface about 3 centimeters from the fixed point, guiding it along under the mucosa, and cutting the fixed point loose from the bone with but slight hemorrhage. The tissues are in this way approximated without undue traction.

(b) Closure by detachment of bladder. Since the days of Jobert, Sims, Emmet, and G. Simon, and their school, the method of denuding the margins and closing a fistula, astonishingly effective even in the worst cases in the hands of our American predecessors, has shown unmistakable signs of falling into gradual disuse, owing to the advent of a new and still better method applicable often with ease to the most difficult cases—a procedure first advocated on a large scale by A. Mackenrodt of Berlin (*Centralbl. f. Gynäk.*, 1894, No. 8). The essence of this innovation lies in the widespread detachment of the bladder, freeing it on all sides from the fistula and the independent suture of its margins, followed by the closure of the vaginal part of the openings as far as possible. This principle of loosening up the bladder as an independent organ

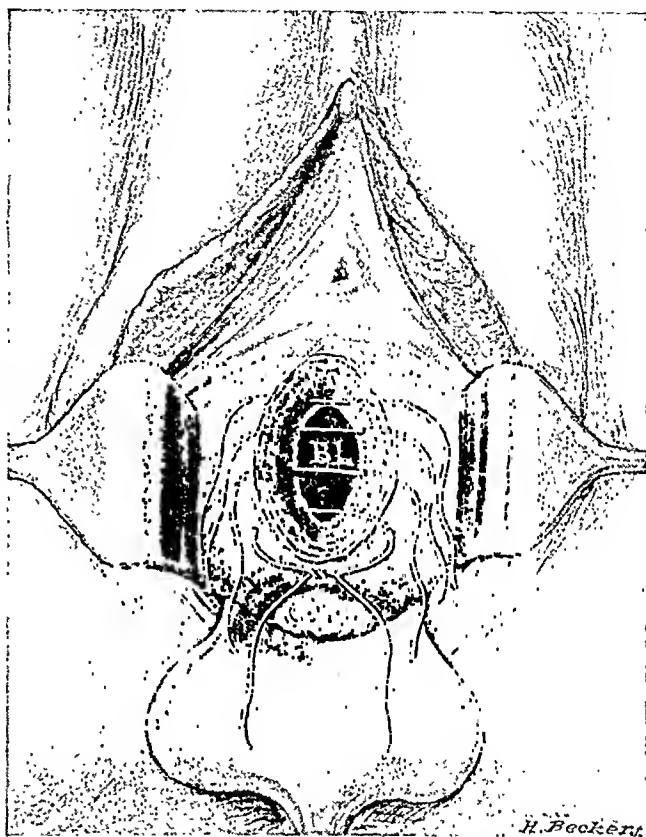


FIG. 690.—CLASSICAL OPERATION, SILKWORM GUT SUTURES INSERTED TRANSVERSELY.

is often a matter of such facility and conveys such assurance of success by the ease with which the flaccid plastic tissues are united in several layers with no sacrifice whatever of tissue, that it deservedly bids fair to control this historic field of plastic work from now on.

The method is as follows:

(1) The fistula is exposed, and the cervix at one end and the urethral prominence at the other, each caught with a pair of tenaculum forceps, and the tissues between made tense by traction in opposite directions.

(2) An incision is next made down the median line across the fistula and through the vaginal walls down to the bladder tissue, exposing the entire base of the bladder as in a cystocele operation.

(3) The edges of the fistula are then split and the bladder dissected from the vagina widely on all sides, even extending the detachment upward, if need be, to the vesico-uterine peritoneum, and as far out laterally as seems necessary to loosen it well on all sides from the vagina.

(4) The lax, movable, detached bladder is now closed by sewing its raw edges neatly together with a continuous fine chromic catgut suture, two or even three rows so as to insure a broad surface of approximation.

(5) After closing the bladder, the vaginal wound is closed as far as the tissues will permit, sometimes making a marked angle with the line of bladder union. It is an advantage to make the vaginal line of suturing as distant as possible from that of the bladder. This is an excellent plan for small as well as large fistulas.¹

In the case of a large fistula bordering on the urethra where there is no room for making a vesical detachment without risk to the sphincter function, an excellent plan is to sew the posterior detached bladder to the anterior denuded vaginal wall. The steps are:

(1) By a crescentic incision, splitting the margin of the opening around the posterior two-thirds of the fistula, and the separation by blunt dissection of the bladder from the cervix and from the vagina laterally, the detachment may be carried up to the peritoneum.

(2) The remaining anterior third of the fistula skirting the urethra is then pared, as in the classical operation, on its vaginal surface, extending the denudation to but not including vesical and urethral mucosæ.

(3) The ureters are next marked out for protection by introducing ureteral catheters through the urethra.

(4) The upper loose part of the bladder is now easily drawn forward and accurately united by interrupted fine silkworm gut sutures to the fixed anterior third of the fistula on its vaginal surface, completely closing the opening, each

¹ For an excellent presentation of this method, see George Gray Ward, "The Operative Treatment of Inaccessible Vesicovaginal Fistulæ," *Surg., Gynec., & Obst.*, Aug., 1917.

suture catching the under surface of the muscular wall of the bladder so as to invert its edge a little into the newly formed bladder. The ureteral orifices directed upward in this way escape compression and transfixion through the presence of the easily felt catheters. No effort is made to draw the rigid vaginal walls together above and at the sides.

I have left ureteral catheters *in situ* for three days, draining both kidneys through the urethra and putting the bladder at rest, thus avoiding any strain on the healing tissues, a procedure which might well be adopted more often.

(c) Opening peritoneum at vaginal vault. We see to-day a fistula, of which our forefathers knew nothing, following the extirpation of the uterus. The opening is small, not over 1 centimeter, high up in the vaginal vault and often fixed in scar tissue. The simple direct plan of denudation and approximation is usually ineffectual, succeeding only in making the hole larger each time. An excellent way to treat such a lesion, when the vaginal outlet is tight and access difficult, is to cut carefully through the scar tissue at the vault, posterior to the opening, guarding the rectum from injury by a finger in the bowel resting on the area being incised until a nick is made in the peritoneum. This is then cautiously enlarged to right and left until the finger tips can be introduced and the opening still further enlarged to the width of the vaginal vault. A little dissection now liberates the fistula which is drawn down into the vagina and denuded if need be and sewed up with two or more layers of sutures. In effecting this closure, peritoneum can be sewed to denuded fistula margin. The peritoneum is partly closed and a cigarette drain left in for two or three days; recovery proceeds uninterruptedly.

(d) Closure through bladder. The transvesical route without opening the peritoneum at times affords an admirable access to a fistula which can be sewed up *in situ* by denuding and uniting its mucous margins; I have also made a large circle of denudation in the mucosa around the fistula at a distance from its margins, then sewed the mobile tissues together, excluding the fistula entirely from the field of operation.

In the transperitoneal route, the peritoneum is opened and the bladder detached from the uterus and if necessary from the vagina and sewed up from above and a drain left from the vagina into the peritoneum.

In the case of fistula with extensive pelvic inflammatory disease, remove the uterus and lateral structures and so set the bladder entirely free. Sew up the fistula from above and drain *per vaginam* as in panhysterectomy.

(e) Extraordinary methods of closure. The extensive defect in the anterior vaginal wall is closed either by bringing the body of the uterus down into the vagina somewhat after the fashion of an interposition operation in prolapsus and sewing the posterior surfaces and the body on all sides to the freshened margins of the fistula (von Rosthorn) or by bringing the uterus out through

the posterior culdesac and sewing its anterior face to the fistula (W. A. Freund).

These procedures have found few imitators and belong almost to the curiosities of surgical literature.

Utilizing the uterus to close the fistula, or Freund's operation, was practiced with success in two women (*Samm. klin. Vortr.*, 1895, No. 118). The first patient had lost the posterior wall of the urethra and a considerable part of the sphincter area at the neck of the bladder. The opening in the bladder easily admitted the index finger; the tissues around the fistula were bound to the pelvic bone by extensive radiating scars, and the cervix was hidden in a mass of scar tissue at the vault. Douglas's culdesac was opened, the retroflexed uterus drawn out into the vagina and scraped until it bled, after which it was sutured to the freshened edges of the opening in the bladder and the posterior half of the urethra. The fundus uteri was then removed so as to open its cavity, and the edges of the wedge-shaped excision were united to provide an exit for menstruation. After a stormy convalescence, the patient was ultimately able to retain the urine, passing it twice in three and a half hours, and could void voluntarily as soon as there was any accumulation in the bladder.

Another was that of a woman of twenty, who had lost the entire base of the bladder, with a perineum torn back to the sphincter, and a high rectovaginal fistula. The urethral orifice was a slit into the urethra for 1.5 centimeters. The fistula was enveloped in extensive scar tissue in which the cervix was lost.

Three months after the operation there was no incontinence.

2. *Vesico-uterovaginal (Fistula laqueatica).*—The best plan of treatment is to detach the uterus from the bladder and then suture the fistula as follows:

(1) The cervix is caught, drawn downward and backward, and detached from the vaginal vault in front. The separation is continued to a point well above the fistula, detaching the bladder from the supravaginal cervix and from the vagina on all sides.

(2) Closure is either by interrupted fine silkworm gut sutures, or chromic catgut sutures, uniting the bladder walls separately in two or three layers.

(3) Finally, the cervix may or may not be reattached at the vaginal vault by two or three silkworm gut sutures.

3. *Vesico-uterine.*—In a vesico-uterine fistula, the urine dribbles through the cervix into the vagina. If the opening is small, the patient may pass some urine naturally, leading to the erroneous conclusion that the fistula is ureteral, easily corrected by injecting milk into the bladder which oozes out through the cervix, as well as by examining the fistulous orifice cystoscopically. Catheterization of the ureters also demonstrates their patency.

The treatment of a vesico-uterine fistula is well described by F. H. Champneys (*Tr. Obst. Soc. Lond.*, 1888, 30). The patient had a generally contracted, flattened pelvis. Her last labor, after four days, was terminated by forceps; on the same day the urine began to dribble.

On injecting the bladder, a large stream escaped through the rather large and flabby cervix, and a bent probe introduced into the bladder passed directly into the cervical canal.

A probe, passed through the fistula, was brought out at the cervix grasped by a vulsella forceps. The operation was that of making a long transverse incision through the anterior fornix, separating vagina and bladder, dissecting upward and freeing the cervix, as in a vaginal extirpation of the uterus; this was carried well above the fistula, dividing it into its vesical and uterine portions. No freshening was required, as the whole surface was raw. Seven fine silver sutures, passed from side to side, closed the vesical opening, and four closed the cervix. The vaginal wall was then reunited to the cervix by four silkworm gut sutures, and a self-retaining catheter left in the bladder and a gauze pack in the vagina. There was complete recovery.

4. *Enterovesical*.—An enterovesical fistula, but rarely seen, is characterized by an opening between the small or large bowel and the dome of the bladder.

The diagnostic symptoms are an intense cystitis with frequent distressing urination, the presence of fecal matter in the bladder often in the form of small seeds, undigested remnants of food, and especially the passage of bubbles of gas from the bladder—which the patient is apt to describe as letting off steam. A cystoscopic examination under complete anesthesia reveals the opening into the bowel into which a probe readily passes.

The abdomen is opened and the affected loop of bowel released from surrounding adhesions, the entire area walled off to prevent contamination and the bowel completely detached from the bladder, with the closure of the openings in both organs with two or more layers of fine chromic gut sutures. If there is any uncertainty in the suturing or contamination, it is well to drain from above through the lower angle of the incision with a peripheral cigarette washed-out iodoform gauze in protective rubber.

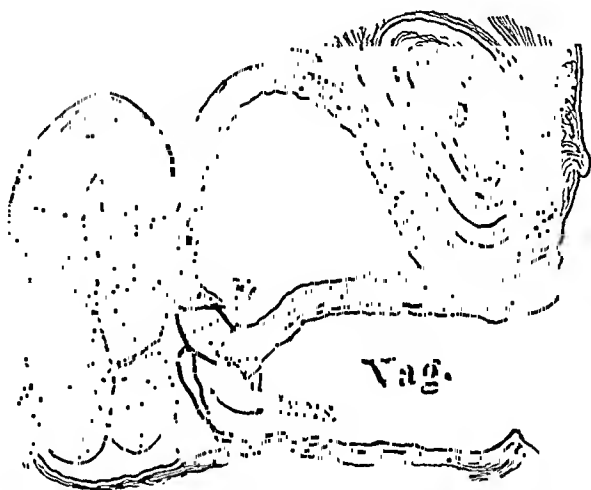


FIG. 691.—VESICO-UTERINE FISTULA TREATED BY DISSECTING BLADDER FREE FROM UTERUS AND SEWING UP FISTULA.

Long arrow shows position of fistula; short arrow points to line of incision in front of cervix, separating cervix (*c*) from vagina (*d*); edges of fistula (*a b*) then approximated and (*c d*) united again.

Therig (*Centralbl. f. innere Med.*, 15) has observed in women two instances of "paratyphlitic" (appendical) abscesses breaking into the bladder, both recovering under irrigation (see also Kelly and Hurdon, *The Vermiform Appendix and Its Diseases*, 1905, pp. 197 and 318).

A colovesical fistula is reported by R. Harrison (*Twentieth Cent. Pract.*, New York, 1895, 1). Air bubbles escaped through the urethra, and granular cells and spiral cells were found in the urine; after death the colon was found adherent to the bladder, and a cherry stone lay in a diverticulum among the adherent intestines.

C. P. Noble (*Med. & Surg. Reporter*, January 19, 1889) observed a recto-vaginal fistula following an old ischiorectal abscess. After the abscess was emptied, she passed wind and small bits of fecal matter by the urethra at intervals. An old extensive vaginal scar from a pessary was found, but no fistula. Noble suggested introducing hydrogen gas into the rectum, which escaped into the bladder, and was lighted at the end of a catheter in the urethra!

5. **Other Vesical Fistulas.**—Aside from the genital fistulas just discussed, communications with other organs are rare.

A fistula may form between the bladder and a tube or an ovary, or between bladder and small or large intestine. Communication between the bladder and a tube or an ovary arises in one of two ways: Either an abscess of the tube or ovary perforates the broad ligament at its base and so finds its way into the bladder, or an ovarian tumor forms adhesions with the peritoneal portion of the bladder which becomes thin and breaks, letting out the contents of the cyst.

An abscess perforating the broad ligament commonly finds its way into the bladder in the neighborhood of the right or left vesical cornu. I have seen a tuberculous abscess of the right tube discharging in this way, with pus in the urine and occasionally tubercle bacilli. The vesical inflammation was most intense at the right vesical cornu where there was a group of granulations, between which a bubble of air oozing out one day revealed the presence and location of the fistulous orifice. On examination under anesthesia, a characteristic contracted right tube and ovary were discovered, hard and adherent at the base of the broad ligament.

A suppurating dermoid cyst may open into the bladder and make its nature known by the escape of hair ("pilimiction") or bones discharged *per urethram*, or even by a tooth found as the nucleus of a vesical calculus. A case of this sort is well described by G. C. Blackman (*Am. J. M. Sc.*, Jan. 1869, p. 49). The patient, thirty-six years old, had a cystitis, and first noticed air escaping from the bladder, and then urine passing per rectum. A calculus was found, containing a tooth; in the course of seven years four similar calculi were extracted, with teeth as nuclei. Some months later, she began passing hairs incrustated with phosphatic deposits.

A patient of Henry Elsner, Figure 692, had a pyuria due to a dermoid cyst, which she had carried for over twenty years; three years before operation the tumor became fixed above the symphysis, and the pyuria followed. The tumor was found at the operation to be a right dermoid cyst densely adherent to and discharging its contents into the bladder; after freeing numerous surrounding adhesions, the dense, fibrous sinus, 3 centimeters in diameter, was dissected out down to the bladder just above the symphysis pubis and cut off, exposing a lumen of about 3 millimeters which was closed with interrupted catgut sutures and covered in with the vesical peritoneum, leaving a longitudinal linear wound. No drain was used. The pyuria disappeared at once and a perfect recovery followed. When drainage is

necessary, it is easy to extraperitonealize the wound by uniting the bladder on all sides to the abdominal wall.

An extra-uterine sac may suppurate and open into the bladder and the nature of the affection first become clear by the discharge of a bone by the urethra.

The symptoms produced by the communication of any of these extravesical sacs with the bladder are those of cystitis, often with fever and chills, the admixture of varying amounts of pus with the urine, and, it may be, elements characterizing the tumor.

The diagnosis will be made by the ordinary, routine, cystoscopic examination, revealing the secondary catarrhal condition of the vesical mucosa and the more intense area of inflammation around the fistulous opening, and by passing a searcher through the fistula into the sac. The injection of the sac with a sodium bromid solution and an x-ray picture are valuable aids in the diagnosis. A bimanual examination usually reveals an inflammatory mass in juxtaposition to the bladder.

The line of treatment to be elected must depend upon the individual case. The general rule is that the distressing local trouble in the bladder tends to a rapid spontaneous recovery when the source of continuous infection is removed.

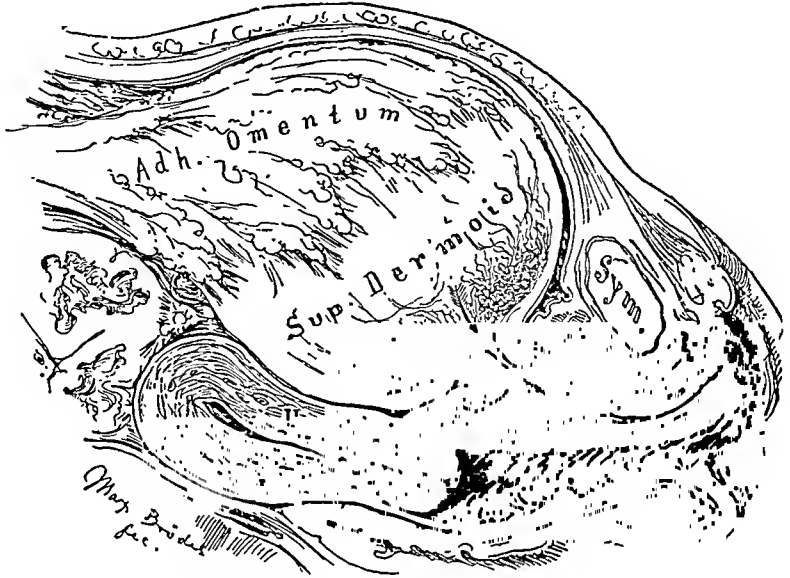


FIG. 692.—PYURIA DUE TO SUPPURATING ADHERENT DERMOID CYST OPENING INTO BLADDER (B).

A sac opening into the bladder should, therefore, either be enucleated or detached from its vesical connection and the discharge stopped. It is sufficient sometimes to evacuate the abscess and drain it by the vagina or above Poupart's ligament.

One of the worst pyurias I have seen was cured by opening and draining an abscess which lay in front of the uterus, through the anterior vaginal fornix. In another, a right pelvic abscess discharging through the bladder was cured by enucleating both tubes and ovaries with the uterus, leaving the vaginal portion of the cervix to be sewed over the fistulous orifice at the base of the broad



FIG. 693.—THREE STYLES OF SELF-RETAINING CATHETERS.

The one generally used seen on right. The holes can be enlarged for irrigations and more rapid drainage. The entire length of the catheters is about 25 centimeters.

ligament. This fistula could not be closed by direct suture on account of the friable inflammatory tissue composing its walls.

After treatment of all fistulas consists in keeping the patient in bed and the bladder empty by a soft rubber mushroom catheter, Figure 693, inserted right after the operation and kept there for from five to seven days. I find it often relieves irritation if the catheter is removed for an hour or two morning and evening.

CYSTITIS

Cystitis, a generic term, covers all inflammatory conditions of the vesical mucosa arising from the invasion of one or other of a group of microorganisms, characterized by the presence of pus and sometimes blood in the urine with vesical detritus. It is important with our definition in mind to exclude from this category several ailments often erroneously designated and treated as cystitis, greatly to the detriment of the patient. I refer to:

1. Women suffering from frequent and painful urination, but lacking the other earmarks, who have no cystitis, but a neurosis or an irritable bladder, a urethritis.

2. A considerable group (G. L. Hunner), with an irritable bladder due to a neighboring ureteral lesion.

3. Patients with a pyuria, from a ureteral or a renal lesion.
4. Pain and frequency from a hyperemic trigonum.

The pertinence of noting these exceptions is patent to the urologist who often sees an irritable bladder converted into an actively inflamed one by routine uncalled for topical treatments.

Etiology.—The efficient microorganisms causative of the various forms of cystitis are the colon bacilli and tubercle bacilli, the gonococci, the various staphylococci, the typhoid and paratyphoid bacilli, several forms of the proteus group, the streptococci, and the *Bacillus pyocyaneus*, as well as leptothrix, pseudodiphtheria bacillus, and other occasional rare forms. The colon bacillus is by far commonest, found in about 57 per cent, varying immensely in its morphology and pathogenicity and giving rise in the past to numerous new names since discarded.

A m o n g predisposing causes which favor the lodgment of these organisms are any depression of health, a severe cold, wasting diseases.

Provocative causes are catheterization without due aseptic precautions, foreign bodies in the bladder associated with more or less retention of urine which becomes ammoniacal and excites intense chemical irritation, or an infection originating in

the immediate neighborhood in an infected fallopian tube or an ovarian cyst, or, again, a renal infection sowing itself as a secondary nidus in the bladder. Tubercle bacilli passing from the blood stream via kidney, or the constant flow of infected urine from a tuberculous kidney, are almost the only efficient agents in a vesical tuberculosis. Residual urine left in the bladder from imperfect evacuations, following parturition or an operation, in part due to

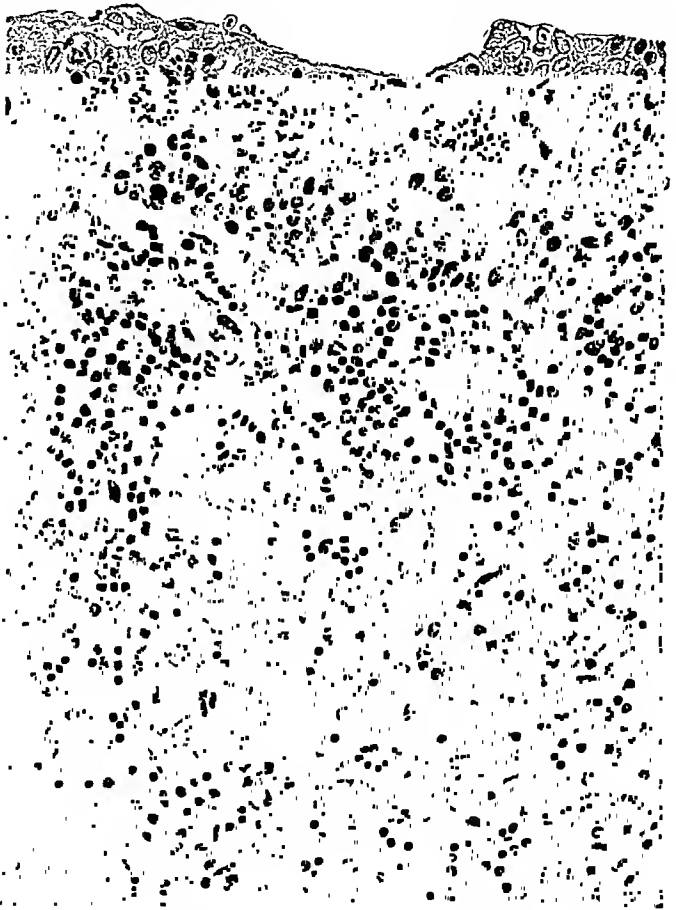


FIG. 694.—SECTION OF BLADDER WALL SHOWING CHANGES IN ACUTE CYSTITIS.

Large spaces in epithelial layer filled with polymorphonuclear leukocytes. Blood-vessels greatly dilated. Mild stage of acute cystitis. (Kelly-Burnam.) $\times 220$.

the unusual recumbent posture in urinating, is probably the commonest of all agents in producing the troublesome hospital cystitis in women (A. E. Curtis).

Pathology.—The pathology of cystitis does not, generally speaking, label itself with features characteristic of the particular invading organism. In the acute stages, the pale mucosa, traversed by the arborescent vessels, larger and smaller, rising up from the submucosa to the surface, disappears, becoming more or less universally injected and hazy, and later intensely red;

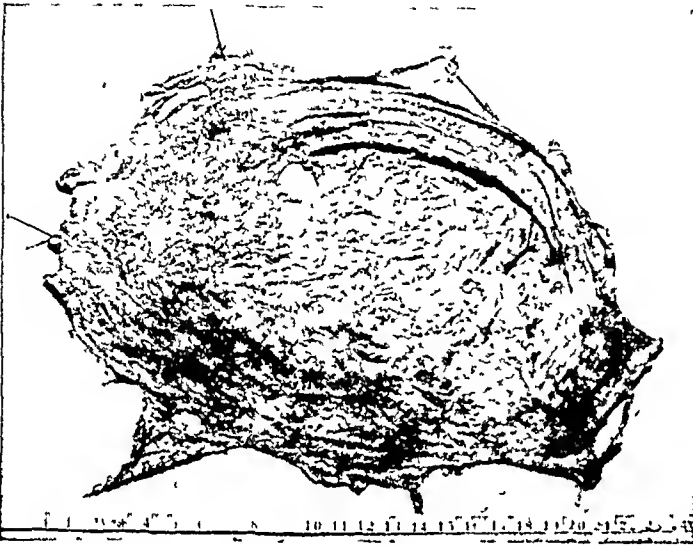


FIG. 695.—SUPPURATIVE EXFOLIATIVE CYSTITIS.

Primipara. 28. Forceps delivery eighteen days previous. Vesicovaginal fistula to relieve strangury, through which she discharged mass in illustration. Patient kept in tub. Regeneration of epithelium and several applications nitrate of silver; complete recovery. (G. L. Hunner.) (W. B. Saunders Co.)

as the disease advances, ecchymoses and erosions appear. If the disease is to be seen in its more aggravated forms, it is imperative to give a sedative and use an anesthetic. With the subsidence of the more acute stages, the inflammation passes into a chronic form with the invasion of the submucosa and later even (if rarely) of the muscularis infiltrated with polymorphonuclear and plasma cells, Figure 694. The shedding of the mucosa in patches leaves an ulcer often extremely slow in healing. Tuberculosis stud-

ding the mucosa with typical tubercles is occasionally recognizable as such; the ulcerated tuberculous bladder bears no distinctive marks. Associated with the tuberculous lesions are often others which heal spontaneously, doubtless due to a mixed infection (colon bacillus or staphylococcus).

Various forms of cystitis are:

1. Hyperemic or catarrhal, mild or severe.
2. Ulcerative; an advanced form of the preceding, bleeding easily; a calcareous form coating the mucosa with urinary salts.
3. Exfoliative, with mucosa detached over areas varying in size from small patches to entire lining of the bladder, Figure 695, associated with foul urine, pus, and gases. H. J. Boldt (*Am. J. Obst.*, 1888, 21) finds this latter condition only in the pregnant or puerperal state. I have seen it arising from an interference with the circulation by an incarcerated myoma.

4. Vesicular, with tiny air vesicles scattered over the mucosa, often following the blood-vessels, due to dilated lymphatics.

5. Bullous edema, looking like translucent granulation tissue, commonly due to a neighboring cervical carcinoma.

6. Leukoplakia, in scattered yellowish or whitish patches, analogous to oral leukoplakias in excessive smokers, consisting of aggregations of horny epithelial cells.

7. Malakoplakia (von Hanseemann, *Virchow's Arch.*, 1903, 173), a rare disease forming soft nodules in mucosa or submucosa from 1 millimeter to 1 centimeter in diameter, found also in ureter and renal pelvis.

8. Cystitis cystica, particularly described by Störk and Zuckerkandl (*Ztschr. f. Urol.*, 1907, 7), a dipping in and budding off of the epithelium forming pseudoglands, like a rectal adenocarcinoma, Figure 696.

9. Calcareous, shining white deposits of lime salts on the walls of the chronically inflamed bladder, a typical picture, commonest in a proteus infection, Figure 697.

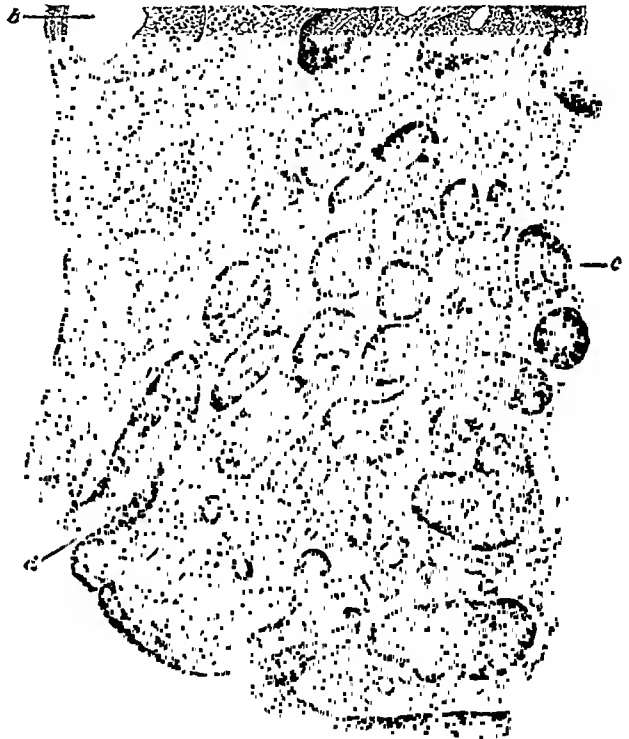


FIG. 696.—EXTENSIVE PSEUDOGLAND FORMATION IN CHRONIC CYSTITIS CYSTICA.
(Störk and Zuckerkandl.)

Symptomatology.—The characteristic symptom is increased frequency of urination, even increasing up to every fifteen or twenty minutes day and night, or in the extreme to a constant strangury with a perpetual flow from the urethra of mucoid bloody urine and pus; a woman so affected suffers more than one with a vesicovaginal fistula, is never free from a foul urinous odor, and, emaciated and distraught with perpetual sufferings and vigils, becomes a recluse from society. Fever is not a pronounced symptom of cystitis.

Diagnosis.—Present-day methods call for a record not alone of the fact of the disease, but as to its particular form, the vesical lesions, its extent and intensity, and complications in the immediate neighborhood as well as the upper urinary tract and elsewhere as elucidated in the course of a thorough general examination. A careful history often forms an important and even decisive

factor in the diagnosis. As Hunner suggests, one does well to begin with the following questions:

What in particular did the cystitis seem to follow?
 Did it come on in the puerperium?
 Was it an acute attack, resembling a gonorrhea?
 Did it follow an operation?
 Was it sudden or gradual in its onset?
 How long since the patient was perfectly well?
 Is there a record of previous attacks?

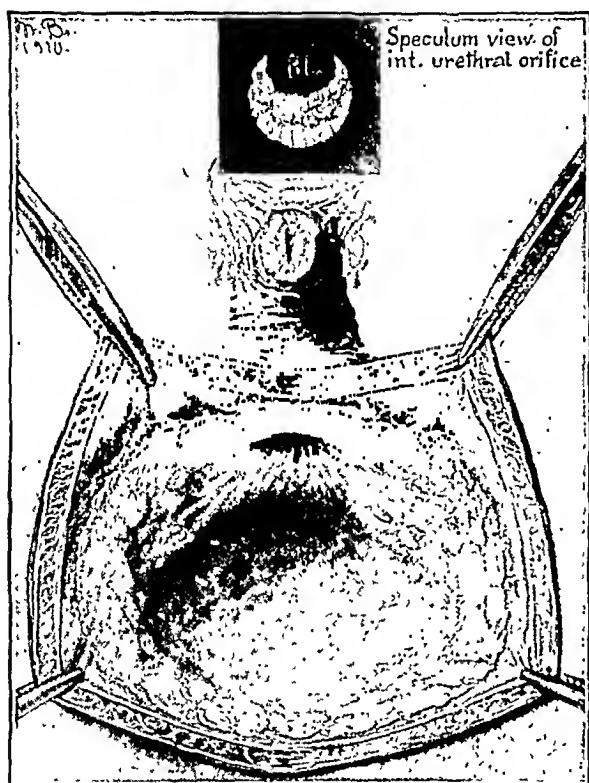


FIG. 697.—EXTENSIVE CALCAREOUS DEPOSITS IN BLADDER IN CHRONIC CYSTITIS.

Encircling bladder between upper movable and lower basal relatively less mobile portion. Calcareous patches just behind each ureteral orifice. (Kelly-Burnam.)

A cystitis coming on, for example, as it were, out of a blue sky, with positively nothing suggestive in the previous history, is apt to be tuberculous or an outpost of a distant focal infection (tonsils?).

The various examinations made to establish a diagnosis are a urinalysis—catheterized specimen—microscopic, chemical, culture; inoculation of guinea-pig to determine tubercle bacillus; digital examination—vaginal and bimanual; cystoscopic examination, often with ureteral catheterization.

Urinalysis.—Pus is always present (intermittent pyuria strongly suggests pyelitis) usually in amounts varying with the intensity of the disease; in tuberculosis there is often but little. One must ever remember that in part at least the pus may descend from the kidney. Considerable albumin and casts also

suggest a renal source. Blood is a variable factor. Most cystitides show acid urine. Alkaline and ammoniacal urine, due to retention and decomposition not so often seen nowadays, is apt to be associated with colon bacillus. The tubercle bacillus is demonstrable with good technique and persistence in 80 per cent in the urine. When the urine is acid, with slight pus, and tuberculosis is suspected, the injection of the sediment under the skin of the inner surface of the thigh of the guinea-pig quickly develops tuberculous glands, easily palpable within ten days, affording positive evidence where the

organisms have been difficult if not impossible to find. Chronic gonorrheal cystitis is rare in women. Smegma bacilli, seen in quantity now and again, must not be confused with infectious organisms; they are plumper in form than the tubercle bacillus, take a more intense blue stain, and are more scattered.

Following up the urinary examination with cultures, Hunner noted in the Johns Hopkins Hospital, in plating ninety-eight times on agar-agar in forty women with cystitis:

- 12, sterile; tubercle bacilli in 1
- 12, pure culture colon bacilli; tubercle bacilli in 4
- 4, pure culture *Staphylococcus pyogenes albus*
- 2, pure culture *Staphylococcus pyogenes albus* (nonliquefying)
- 1, pure culture *Staphylococcus pyogenes aureus*
- 2, pure culture streptococci
- 2, pure culture *Bacillus ureæ*
- 2, pure culture saccharomyces
- 3, mixed infection cultures:
 - 1 colon and *Staphylococcus pyogenes albus* (nonliquefying)
 - 1 colon and *Staphylococcus pyogenes albus*
 - 1 unidentified organism

Palpation.—Palpation by the vagina or bimanually usually shows some more or less marked tenderness of the bladder, at times extreme and unbearable. Rarely, the whole organ is thickened and feels like a globular tumorous mass behind the symphysis, overlying the anterior vaginal wall.

Cystoscopy.—Of all the methods, cystoscopy furnishes the most satisfactory, complete, and certain knowledge as to the exact condition of the interior of the bladder and is in these days a *sine qua non* in the chronic phases. Such an examination is best made in the knee-chest posture, reserving the male water cystoscope for the occasional obese woman whose bladder does not expand well posturally.

One notes in the examination any limitation in the expansion of the bladder and the conditions of the mucosa on all sides, beginning with the posterior wall, sweeping to right and to left for the lateral walls, then taking in the vertex and finally the base, the ureteral areas, the trigonum, the periurethral tract, and, as the cystoscope is withdrawn, observing minutely the urethral mucosa. The degree of inflammation varies often extremely in different parts; the localization of the infection is noted, measured, and described, Figure 698. Areas of ulceration in particular are registered, with a sketch (however crude), for comparison in determining subsequent improvement and whether treatment is effective or not.

It is often highly necessary to catheterize the kidneys in order to exclude

them from or include them in a participation in the process. If the inflamed condition of the bladder makes this inadvisable, one can watch the ureteral orifices and determine whether they are functioning regularly and naturally, and by holding the speculum under the orifice a little urine can be collected, enough for a microscopic examination.

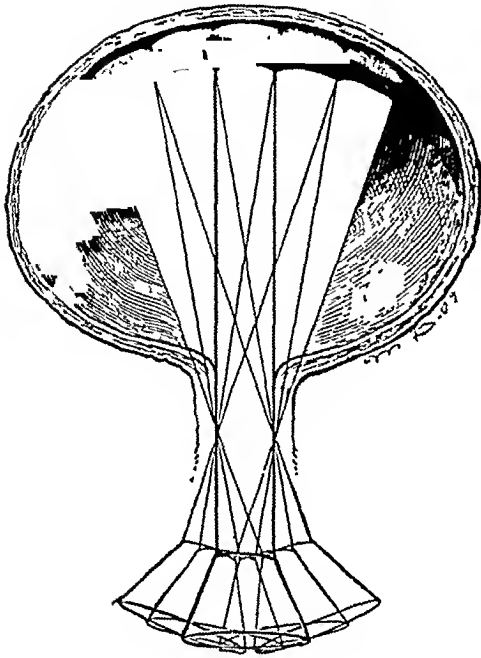
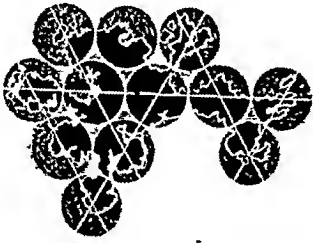


FIG. 698.—CYSTOSCOPE USED TO MEASURE AND PLOT OUT AREA OF DISEASE.

Diameter of cystoscope being known, it is easy to use it like a tapemeasure to ascertain height, width, and irregularities of any lesion in any part of the bladder, which can be touched by its distal open end. The upper figure shows an irregular patch of ulceration charted as described.

Avoid unnecessary catheterizations; at the same time strenuously avoid residual urine by catheterizing when necessary at regular intervals. The residuum is determined by catheterizing after urination. Hot-water irrigations to the perineum and warm rectal enemata help to start the act. Use water freely as a diluent and give urotropin, 5 or 10 grains, three times a day, if there are threatening symptoms. It is often wise after catheterization to inject into the empty bladder nitrate of silver 1:1,000, or a 1 per cent solution of mercurochrome.

5. The care above outlined must follow all surgical operations which in-

Prophylaxis.—Duly applied, prophylaxis often prevents cystitis with all its attendant disabilities; recourse to prophylaxis depends upon the recognition of sundry causative factors, destined in due course to bring about a cystitis if not eliminated.

1. A kidney, recognized as pronouncedly tuberculous, demands prompt removal to prevent the distressing vesical sequelæ.

2. The removal of the pelvic tumors, and in particular of a tuberculous uterus and pns tubes, is in a high degree preventive.

3. In doing pelvic operations, one must avoid rough handling of the bladder; in detaching it from the uterus any rubbing down must be against the uterine cervix, or the detachment must be made as a clean knife or scissors dissection. The bladder is easily rubbed into ridges, producing sugillations liable to infection.

4. Particular care must be taken in the puerperium to avoid infecting the bladder with a contaminated catheter or by careless hands of physician or nurse.

volve the bladder in any way. When there has been much interference with the bladder, it is sometimes well to leave in a drainage catheter for a few days until the patient is in a fairly normal condition.

Treatment.—*Acute Cystitis.*—Acute cystitis is, generally speaking, a *noli me tangere*, as to topical treatments, as any manipulation of the local condition only aggravates the trouble. The better plan is expectant measures, awaiting the subsidence into the subacute and milder chronic forms. Hygienic measures should be inaugurated promptly.

The bed is a sheet anchor in treatment, limiting motion and conserving the nervous forces of the body to throw off the infection. Next comes the injection of an abundance of water. It was formerly the custom to give fluid extract of buchu, fluid extract of triticum repens, and the fluid extract of zea mais, with the utmost confidence in their therapeutic efficiency. How far, however, these or other like remedies may be helpful, or in how far they really depend on the considerable quantity of water ingested along with them, I cannot say ("judgment is difficult"!).

In gonorrheal cystitis, balsam of copaiba is helpful; in colon bacillus and typhoid infections, urotropin should be given and pushed in substantial dosage. Hexylresorcinol in doses of 0.15 gram suspended in olive oil in capsules, t.i.d., is being tried out in various forms of cystitis and is more efficacious in a staphylococcus infection.

In a milder stage of the disease, irrigations of the bladder with a weak boric acid solution is a useful adjuvant.

Should an acute condition persist and prove too exhausting, it is occasionally justifiable to open the base of the bladder under complete anesthesia, to drain it, checking the incessant painful urinations.

Chronic Cystitis.—The methods are directed toward the conservation of general health, the elimination of the infection from whatever source, and the restoration of the injured bladder to its integrity.

A treatment of the chronic cystitis based upon the nature of the infecting organism is sometimes possible, but not often available. Those organisms likely to be affected by a drug or by some generally applicable specific form of treatment are:

Tubercle bacillus
Gonococcus
Colon bacillus
Typhoid bacillus
Staphylococcus
Streptococcus
Proteus

Vesical tuberculosis is likely to be helped by a thorough radiation (radium or x-ray), so effective in peritoneal tuberculosis. Here also, oil of copaiba and

sandalwood act more or less as specific in the gonorrheal form of cystitis and the colon and typhoid bacilli are more amenable to urotropin, also more or less effective with the staphylococci and streptococci. In proteus infection with alkaline urine, the best therapy is benzoic acid, 10 to 15 grains, until the urine is acid; this followed by urotropin.

If the disease is at all aggravated, the goal of the patient, until vastly better, ought to be her bed, where a Gatch frame will add much to her comfort, Figure 325. Diet should be simple, restricted, and nonstimulating. Between meals, the patient should imbibe water in abundance with citrate of potash and tincture of hyoscyamus in doses of 20 grains and a dram, respectively, about every three hours. A daily warm bath keeps the skin active and is a substantial help.

Hexamethylenamin (urotropin) is so valuable an adjuvant that I detail here the method of giving it, worked out by C. F. Burnam. There are two important considerations: (1) testing the urine to show the presence of formalin and its strength, dependent upon the breaking down of the drug at the kidney level; (2) getting the formalin into the urine, in case the drug passes through the kidney unchanged, as in alkaline urines.

A chief factor is the limitation of the ingestion of fluids plus a high protein diet, plus (occasionally) when the drug does not break down, acid sodium phosphate in quantities equal to the urotropin taken, and, finally, a regimen increasing the amount of the drug to toleration, while watching the urine for the progressive disappearance of the infective organisms.

Whichever of the above plans is adopted, it must be clearly outlined with good reasons for the expectation of efficiency, as well as consistently carried out over the period demanded to make a fair test. One must not be discouraged and give up or change easily, influenced by the complaints of the patient. In our earlier, more or less experimental years, I worked even for several years with some of these distressed sufferers before getting them well.

One must also be ready, when one course proves futile, to turn with hope to another. With this in view, it is wise at the beginning to warn the patient that it may be a long battle, and to outline a possible succession of plans; say, for example, rest with medication by mouth, followed perhaps by irrigations, again followed by distention and later, in case of failure, by opening and draining the bladder or even ultimately by excision of a localized diseased area.

The estimation of improvement is most important as a guide in the treatment as well as by reason of its psychic effect. First of all, the patient may announce that she feels definitely better, urination is less frequent and less painful, and she gets more sleep. The urine begins to clear up; there are fewer pus corpuscles on a slide made from a catheterized specimen or as estimated by the sediment in a conical glass; fewer bacteria are found; and, finally, most important, a cystoscopic examination of the bladder shows marked diminution in the area and intensity of the inflammation.

The effect of the local treatments faithfully applied is often to eliminate secondary infections and to reduce the more or less extensive diseased area to a moderate residual focus, when perhaps a linear or a small round ulcer, concealed in the earlier period, now requires direct aggressive treatment.

The several plans of treatment available, either singly or combined, are:

Elimination of extravesical foci causing the disease
 Irrigation and instillation
 Irrigation and distention
 Endothermy
 Topical
 Drainage
 Excision

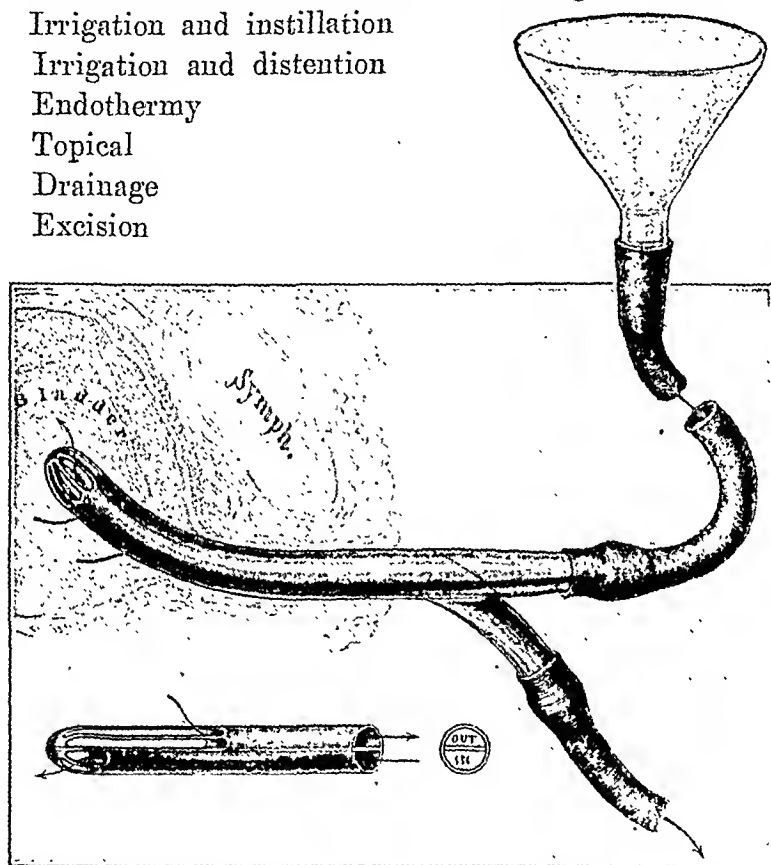


FIG. 699.—IRRIGATION OF THE BLADDER BY TWO-WAY CATHETER.

If used for distention the exit catheter is clamped off. (Kelly-Burnam, *Diseases of the Kidneys, Ureters, and Bladder.*)

1. Elimination of Extravesical Foci.—Always a first thought must be that the disease may be provoked and maintained by some extravesical focus, and this until the contrary is proved by the examination. Suspicion falls first upon the kidney and the ureter, eliminated by catheterization of the ureter. Other external factors are an adherent vermiform appendix, or tubo-ovarian disease. Distant focal infections (tonsils) uniformly call for consideration. When such extravesical foci are present, local treatments are obviously only palliative until the *fons et origo mali* is readily removed, and this clears up the vesical disease without further local interference.

The most brilliant relief of an aggravated distressing cystitis is that following the discovery and removal of an unsuspected vesical calculus.

2. Irrigation and Instillation.—The exact condition of the bladder with the location, form, and size of any lesions observed, are registered as described above and referred to at intervals to estimate the improvement.

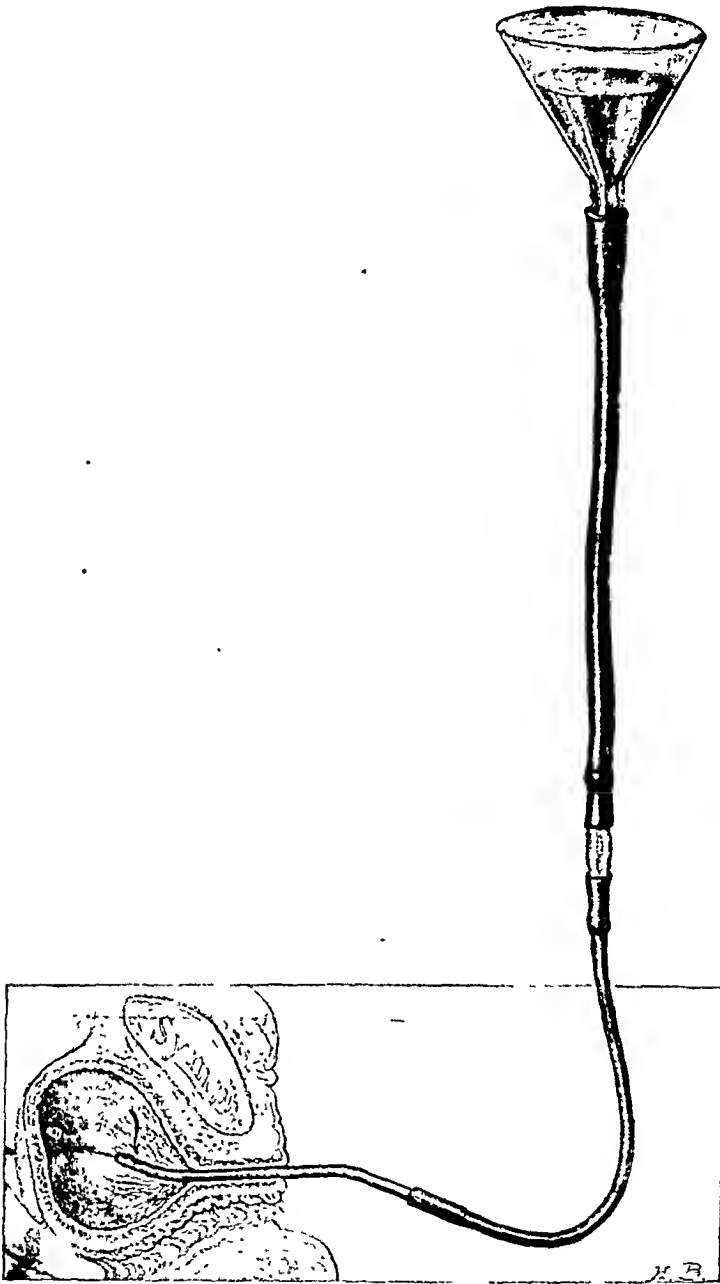


FIG. 700.—APPARATUS FOR DISTENTION.

Amount of distention is regulated by height of funnel. There should be no air in the tubing before inserting catheter. Use the first washings to clear out the bladder by inverting and emptying the funnel; afterwards funnel can be raised and lowered to exercise bladder and increase its excursus of tolerance. (Kelly-Noble, *Gynecology and Abdominal Surgery*, W. B. Saunders Co.)

The purpose of irrigation is, by the use of abundant water, holding in solution some bland or mildly antiseptic drug, the removal at intervals, once or twice daily, of the irritating pus and toxin accumulations in the bladder.

The simplest irrigation is with a hot solution of common salt (105° F.), once or twice daily passed into the bladder through catheter, rubber tube, and funnel, Figure 699. In more serious and protracted cases, a special bed is provided, with mattress, with a removable plug in the middle adjusted to a suitable rubber apparatus, securing the immediate discharge of the flushing fluids into a vessel under the bed. Such irrigations should gradually be extended to from one to several hours, once or twice daily.

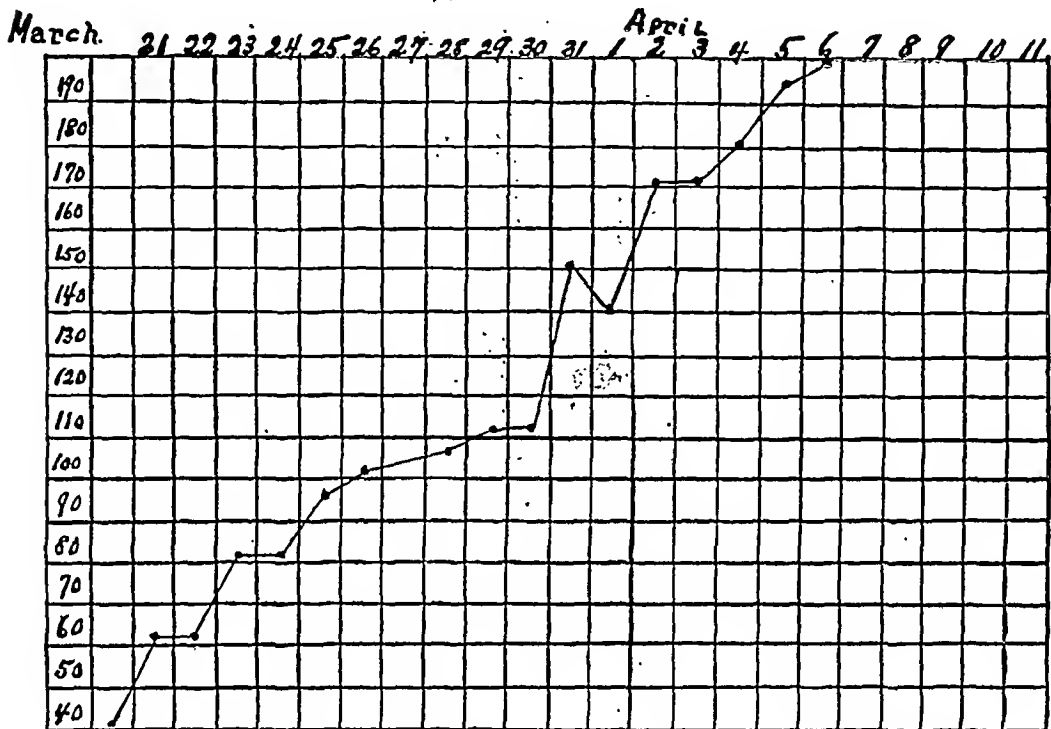


FIG. 701.—CHART SHOWING RESULTS OF DISTENTION TREATMENTS.

Hang on wall in patient's room as an encouraging exhibition of progress to secure coöperation. Chart should be taken down during menstrual period or suspension of treatment.

Excellent irrigants are soda and borax in weak solution, acid carbolie, 0.5 to 1 per cent, nitrate of silver from 1:1,500 and down, bichlorid of mercury from 1:5,000.

After irrigation, it is often advantageous to instill into the bladder 20 c.c. of a 1:1,000 solution of nitrate of silver, or a teaspoonful of a 50 per cent solution of argyrol, or a solution of protargol from 1 to 10 per cent, according to tolerance, or mercurochrome, 1 or 2 per cent.

3. Irrigation and Distention.—In old inflamed bladders, the organ is often contracted and refuses to hold more than 20 or 30 c.c., and is so obstinate to every effort to dilate it that a restoration *ad integrum* is apt to appear hopeless; but even in such, while it may take months of patience, we often in the end register our most brilliant successes by the persistent employment of irrigation plus daily distentions, Figure 700. I like to begin such a

course with a chart hung on the wall, Figure 701, about 2½ feet long by 20 inches, plotted to cover a month's treatments, starting with a base line, which is the capacity of the bladder when first tested. The improvement goes on



FIG. 702.—INCISION FOR THOROUGH DRAINAGE OF BLADDER, USUALLY MADE WITH KNIFE BLADE SET ON HANDLE AT AN ANGLE, ENLARGED FORE AND AFT, GUARDING URETHRAL ORIFICE BY INTRODUCING INDEX FINGER TO ASCERTAIN ITS POSITION.

(Kelly-Noble, *Gynecology and Abdominal Surgery*, W. B. Saunders Co.)

slowly week by week, rather than daily; the patient, with the luminous graphic illustration and its appeal to her pride and coöperation ever before her, is thus encouraged to endure some of the discomforts of the increasing distentions as the funnel is held higher and higher, and the bladder yields to the pressure. The beginnings are the most difficult. Fortunately an enlargement in capacity is coupled with an amelioration of symptoms. It is usually well to rest from

treatments during menstruation when there is also likely to be a slight regression.

Burnam recommends the use of 0.25 per cent carbolic acid as a mild sedative and antiseptic in making the distention.

4. *Endothermy*.—Either a strong desiccation or a mild coagulation current through the open air cystoscope is valuable in clearing up quickly small residual ulcerated areas after the subsidence of the more extensive inflammatory lesions, a procedure not calling for anesthesia (Chapter XLVIII).

5. *Topical*.—Topical treatments consist in a 5 or 10 per cent solution of nitrate of silver to localized ulcerated or persistent well-localized small areas of inflammation. One easily limits the application of such a strong remedy by pressing the end of the speculum against the bladder wall, so as to sequester it, and then touching the spot with the swab and drying off the surface, this to be followed by similar applications in neighboring areas. It suffices to give treatment once in from seven to ten days.

6. *Drainage*.—When the distress is extreme, and there is no immediate prospect of speedy relief, and the patient is worn out with her sufferings and vigils, the most aggressive and often the wiser plan is to make a liberal longitudinal incision in the base (*bas fond*) to put the bladder at rest. Two things are important: To make an opening of sufficient length, carefully avoiding encroachment on the urethral area, Figure 702, and the suturing of the vesical to the vaginal mucosa, Figure 703.

The opening is readily and rapidly made, with the patient in the knee-chest posture and the bladder filled with air.

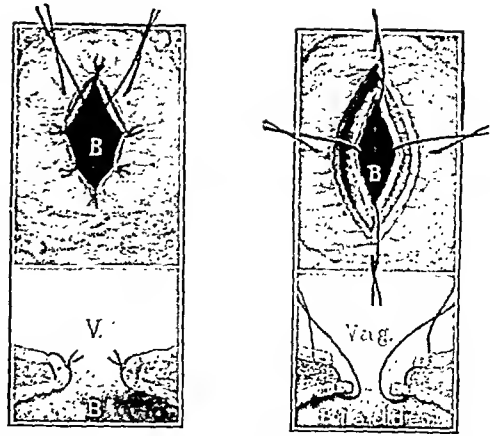


FIG. 703.—SUTURE OF VESICAL TO VAGINAL MUCOSA TO MAINTAIN PERMANENCE OF OPENING WHICH AS A RULE SHOULD BE MADE SOMEWHAT LARGER THAN SHOWN. (Kelly-Burnam, *Diseases of the Kidneys, Ureters, and Bladder*.)

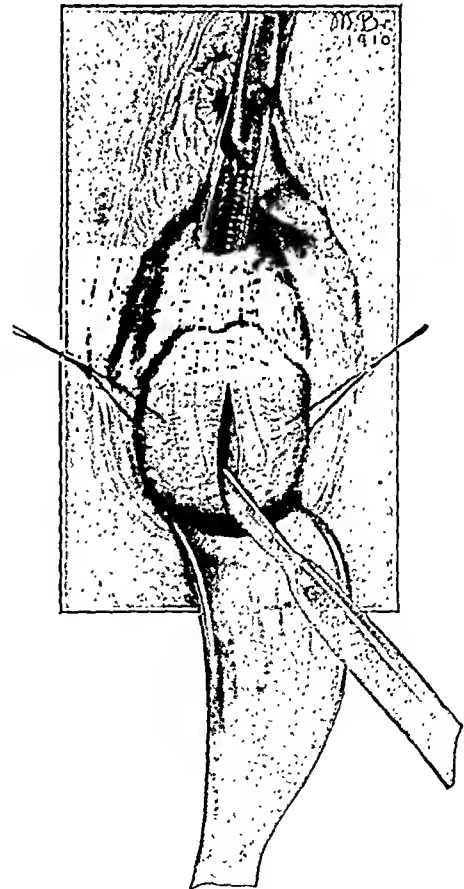


FIG. 704.—DUDLEY'S OPERATION, OPENING BLADDER FOR DRAINAGE USING BLUNT CURVED FORCEPS THROUGH URETHRA—PATIENT IN LITHOTOMY POSTURE—FORCEPS PUSHING BLADDER WELL FORWARD WHILE INCISION IS MADE. (Kelly-Burnam, *Diseases of the Kidneys, Ureters, and Bladder*.)

Any uncertainty as to where to cut is settled by introducing a sound through the urethra and lifting up the bladder wall at a point about midway between vaginal vault and urethral sphincter. E. C. Dudley's plan is to make the opening with the patient in the dorsal posture as shown in Figure 704.

If the two mucosas are not united, the opening, which may be needed for a drainage to last some weeks, is sure to close rapidly.

The operator has a good chance, when the incision is made, to explore the interior of the bladder and with a piece of gauze on the end of his finger, to rub the infected areas vigorously.

Constant drainage by a catheter in the urethra for a week or longer is sometimes helpful if the instrument is tolerated.

7. *Excision*.—Excision of the ulcerated area is rarely useful except in single, large, sharply defined, punched-out ulcers. The radical removal of smaller, more or less scattered ulcers and of the elusive ulcer of Hunner has not proven satisfactory, owing to the number of recurrences, fully 50 per cent. The difficulty is that the ulcers penetrate all the coats of the bladder, involving peritoneum and perivesical fat, and that the process is more or less generalized, probably dependent on causes which are not local.

CHAPTER XLI
URETERAL STRICTURE
GUY L. HUNNER

DEFINITION

ETIOLOGY

INCIDENCE

Age

Sex

Race

Social Condition

MORBID ANATOMY

SYMPTOMS AND DIAGNOSIS

General Considerations

Dysmenorrhea

Ovarian Neuralgia

Dyspareunia

Descensus

Menorrhagia

Incontinence

Cystoscopy

TREATMENT

Definition.—Ureteral stricture is an intrinsic disease of the ureteral wall, resulting in a narrowing of the lumen, and giving rise to varying degrees of stasis in the urinary stream.

Etiology.—This narrowing may be congenital or acquired, the congenital types probably most often representing anomalies of development. Wide clinical experience has led us to believe that most ureteral strictures are acquired. We see an occasional stricture of traumatic origin either from a severe accident, a gunshot or stab wound, or from injury at operation or childbirth. Syphilis may be responsible for an occasional case. We have seen one stricture located at the pelvic brim which was apparently secondary to the pressure and inflammatory action of an adherent ovarian cyst. Pressure by uterine fibroids may cause hydronephrosis and hydro-ureter above, but apparently without causing intrinsic disease of the ureteral wall. Adenomyoma as it spreads across the pelvis sometimes involves the ureter, causing stasis from encircling pressure. Cervical inflammation probably gives rise to some strictures in the broad ligament region. Gynecologists in operating for cancer of the cervix often see serious ureteral involvement in the broad ligaments. The inflamma-

tory process in these cases may involve the periureteral tissues more than the ureteral wall itself and may be present at the time of operation, or it may follow the inevitable trauma and infection due to operation. In a new group,



FIG. 705.—BILATERAL URETERAL OBSTRUCTION FOLLOWING USE OF RADIUM TO CONTROL IN-
OPERABLE CERVICAL CARCINOMA.

Right side shown here.

of which we have seen several examples, the periureteral and ureteral infiltration in the broad ligament region has apparently followed the use of the cautery or radium, before, during, or after the operation, Figures 705 and 706.

Our clinical experience has led to the belief that the large majority of



FIG. 706.—SAME AS FIGURE 705. LEFT SIDE.

After two radium treatments for large fungating inoperable cancer, returned a year later with severe pain in right side. Cystoscopy revealed dense infiltration of lower end of each ureter, right kidney holding 120 c.c. and left 40 c.c.; urine free from pus. Urograms taken with catheter entirely out after marked reduction by better drainage. After three dilatations of each side one-half hour intravenous phthalein test gave:

Right (catheter) in 6 minutes,	100 c.c.	22 per cent
Left (bladder) in 10 minutes,	90 c.c.	25 per cent

strictures are secondary to a focal infection in some other region of the body, particularly to foci about the head. Recent work in the autopsy room makes it appear that we have not sufficiently recognized congenital anomalies of development as a factor in the etiology of stricture.

Martin Schreiber of New York (personal communication) last year was

granted the privilege, at the Senkenburg Pathological Institute of the Medical School of the University of Frankfurt, of following one hundred consecutive unselected autopsies for a detailed study of the urinary tract. His material comprised forty-two adult males, ages twenty-two to eighty-seven; thirty-seven females, ages twenty to eighty-one; twenty-one children, ages seventh month prenatal to fifteen years. In brief, Schreiber found an incidence of 12 per cent of ureteral lesions that would correspond to our conception of ureteral stricture; *i.e.*, a thickening of the ureteral wall sufficient to cause a dilatation of the tract above which might have been demonstrated *in vivo* by urogram and which would have caused a hang of the bulb if this test had been used.

Schreiber divides his twelve cases into "5 showing so-called congenital accentuated narrowing of physiological narrow sites; 2 as kink obstruction due to crossing anatomical structures, the vas deferens in one case and the uterine artery in one; 1 as due to external pressure of a massive adnexal tumor; and 4 as caused by definite inflammatory processes involving the ureteral wall."

It is of interest from the medicolegal viewpoint that some patients with well-defined signs and symptoms of ureteral stricture date their ill health from a fall or a blow, or from a traumatic injury received on a public conveyance or in an automobile accident. Careful anamnesis in such cases often elicits a history of dull backache, slight bladder trouble, or mild gastro-intestinal discomfort before the occurrence of the accident, which was followed by such exacerbation of these symptoms as to cause serious complaint. In all probability the patient had had latent stricture for years and the sudden strain or contusion of the stricture area set up a renewed inflammatory reaction resulting in exaggeration of the symptoms.

Many patients with symptoms which we find due to stricture date the onset from the time of a pelvic operation or from a certain childbirth. This may mean that there was special injury to the ureteral walls at such time, but more often it means that the patient had latent stricture which was sufficiently disturbed at the operation or childbirth to set up a new abdominal or pelvic syndrome. A chronic pyelitis which seems to have had its acute origin under similar circumstances usually means that the stricture was present before the operation or childbirth, when the unavoidable trauma induced a more complete closure of the lumen with increased stasis leading to infection of the kidney pelvis. The temporary reduction of the patient's resistance after operation or childbirth, and an increase of microorganisms in the general circulation are probably contributing factors in the determination of a kidney infection.

In 1908, G. L. Hunner (*J. Am. M. Ass.*, 1908, 50) reported certain cases of acute pyelitis due to acute appendicitis. After the publication of that report, two of those patients returned with symptoms which were found to be caused by ureteral stricture. Several similar cases have been seen since that time and in all of them an examination after the acute symptoms had subsided has

shown the presence of ureteral stricture. In such cases it is probable that the acute appendicitis results in neighboring local peritonitis which reaches the ureteral walls and causes a more complete closure of a latent narrow area.

Incidence.—*Age.*—Ureteral stricture occurs at all ages.

Sex.—Both sexes are probably equally subject to this disease. Rathbun (*J. Urol.*, 1925, 45: 403) at his urological clinic of the Brooklyn Hospital, has about an equal number of both sexes applying for treatment and, in 1924, a careful urological study of 739 patients showed an incidence of ninety-two strictures, forty-eight found in men and forty-four in women.

Race.—At our Johns Hopkins Hospital Women's Cystoscopic Clinic we have perhaps one-fourth as many colored patients as white and we apparently find an equal proportion of stricture incidence in the two races.

Social Conditions.—We have noticed no predilection of stricture for the poor or the well-to-do, for the undernourished, or the robust.

Morbid Anatomy.—The simple and delicate anatomic structure of the ureter makes a study of its pathology of relatively little interest, and our future concern with the pathology of ureteral stricture will be centered largely in a study of its secondary results as represented by most of the so-called surgical conditions of the kidney. See Figures 707 to 711.

The few specimens of ureteral stricture which we have been able to obtain at operation or autopsy have shown the typical picture of a chronic inflammatory process involving all coats of the ureteral wall. The epithelium at the stricture site is altered from the transitional stratified type to a more squamous type, and in one specimen definite ulceration was found with absence of the epithelium. The muscle-bundles are replaced by fibrous tissue, and marked round-cell infiltration is noted. The periureteral sheath is sometimes markedly infiltrated and fused with the muscle layers. See Figures 712 and 713.

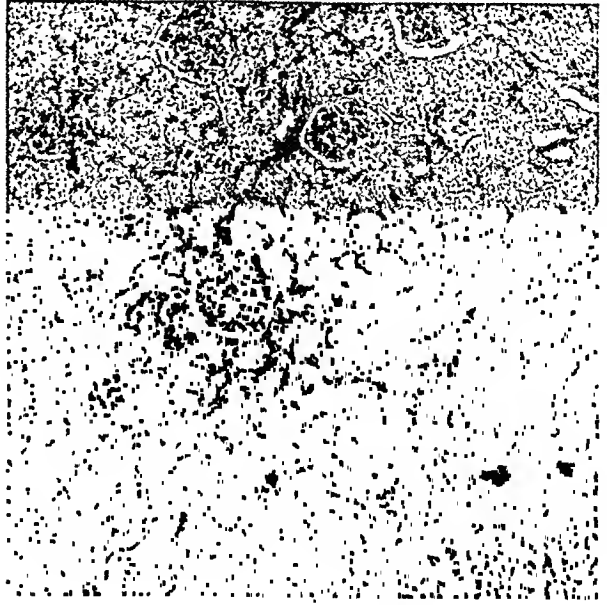


FIG. 707.—SLIGHT CHANGES IN KIDNEY FROM STASIS DUE TO STRICTURE DEMONSTRATED CLINICALLY IN BROAD LIGAMENT REGION.

Kidney removed on probable diagnosis of tuberculosis. Although an operation specimen placed in hardening solution at once, degenerative changes are detected in tubular epithelium. Note absence of inflammatory tissue. Other areas of section showed more clearly dilatation of tubules.

¹ Figures 707 to 711 are borrowed from Hunner and Wharton, "The Pathological Findings in Cases Clinically Diagnosed as Ureteral Stricture," *J. Urol.*, 1926, 15: 57.



FIG. 708.—SAME AS FIGURE 705. MICROPHOTOGRAPH OF URETERAL WALL A FEW CENTIMETERS BELOW KIDNEY.

Plication of epithelial surface probably due to hardening specimen without first distending with fluid. Marked hypertrophy of entire wall; widening and edema of submucosa, with slight round-cell and plasma-cell infiltration; hypertrophy of muscle-bundles, increase in fibrous tissue, and fusion of periureteral sheath.

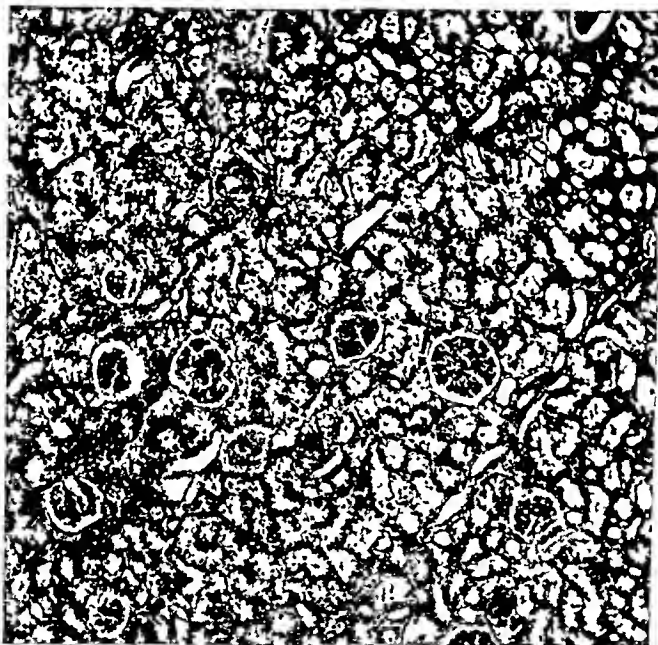


FIG. 709.—EVIDENCES OF MORE ADVANCED DAMAGE TO KIDNEY.

Panhysterectomy for cervical cancer fifteen years previous. Pain in left side for eight years. Ureteral stricture, bilateral. Left ureter could not be dilated by vesical route. Extra-peritoneal exposure for retrograde dilatation. Stricture in broad ligament region not dilatable retrograde; nephrectomy. Note dilatation of renal tubules, flattening and degeneration of many epithelial cells, areas of round-cell infiltration. Culture from kidney urine at operation gave no growth. Compare with less advanced case, Figure 707.

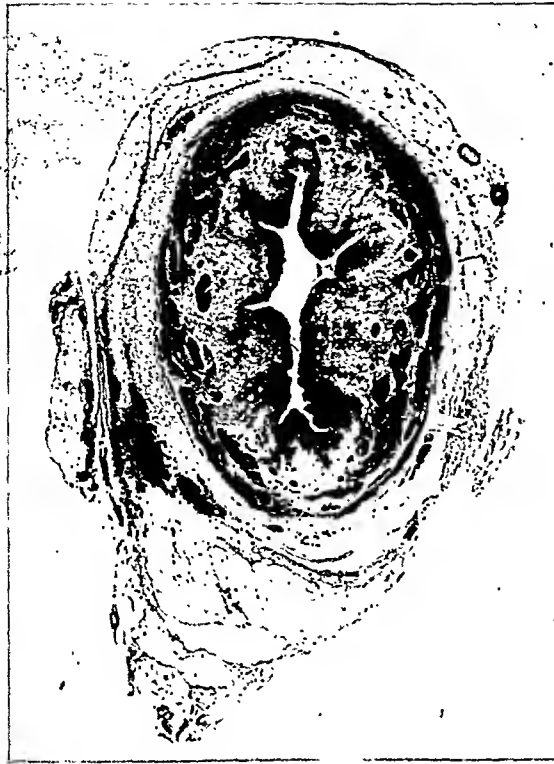


FIG. 710.—SAME CASE AS FIGURE 709.

Edema of submucosa; edema and fibrosis of all layers; also muscle hypertrophy. Compare with ureteral specimen from less advanced case, Figure 708.

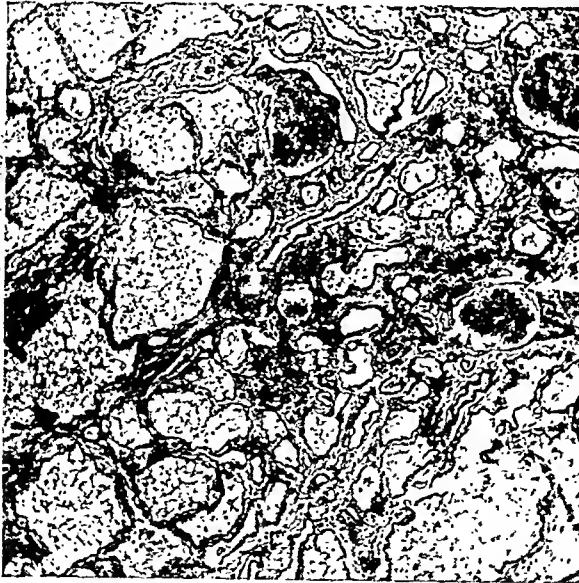


FIG. 711.—KIDNEY SECTION FROM BILATERAL STRICTURE OF URETERS IN CHILD OF THREE.

Hydro-ureter; hydronephrosis. Note marked dilatation of renal tubules, cuboid epithelium, small round-cell infiltration, and fibrosis. Bladder urine free from infection. Right ureter had been dilated twice, bulb showing marked hang in broad ligament region. Left ureter impassable by vesical route. At autopsy the finest silver probe failed to pass stricture area from above. Compare with Figures 707 and 709.

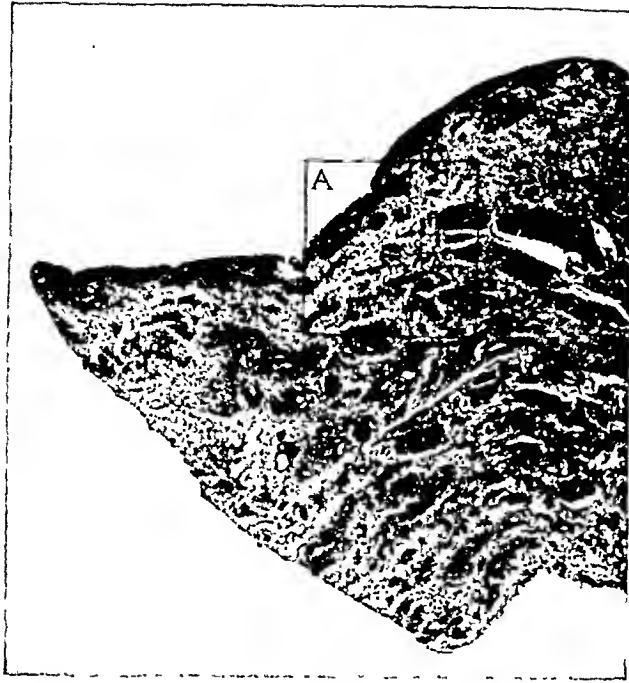


FIG. 712.—SECTION OF URETERAL WALL THROUGH STRICTURE OF RIGHT URETER, 4 CENTIMETERS ABOVE BLADDER.

Death on twenty-sixth day after acute postoperative pyelitis and septicemia with hemolytic streptococci. Supravaginal hysteromyomectomy. Partial resection of bladder for elusive ulcer. Ureteral wall 7 millimeters thick at this point, two or three times normal thickness. Note thickening and fusion of perihurteral sheath.

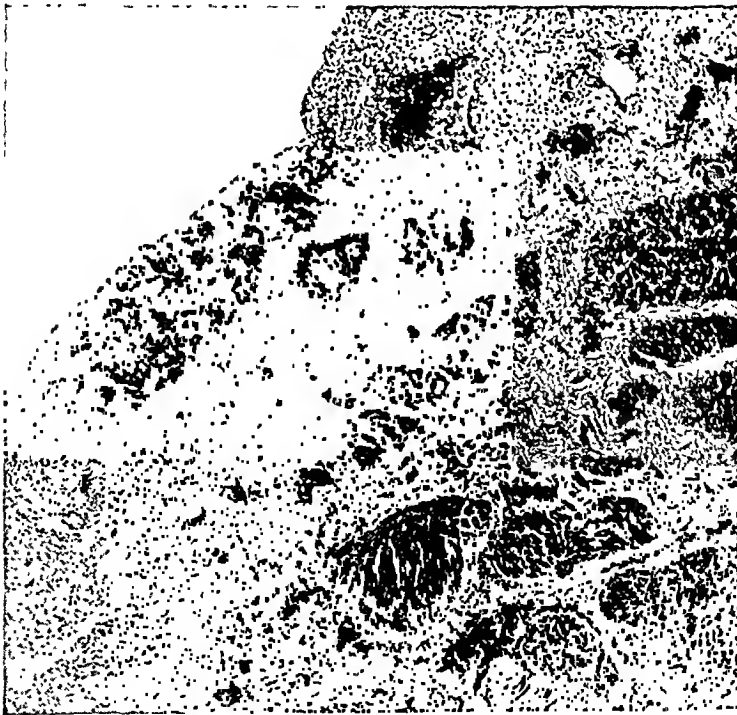


FIG. 713.—HIGHER MAGNIFICATION OF BLOCK OUTLINED IN FIGURE 712, THROUGH STRICTURE OF RIGHT URETER.

Unmistakable signs of chronic inflammation; fibrosis and small round-cell infiltration; hypertrophy of muscle-bundles.

We have had far more frequent opportunity for gross anatomical studies incident to operations for the retrograde dilatation of stricture which could not be dilated by the vesical route, and for other pelvic and abdominal lesions in patients who have been previously treated for stricture.

In some cases stricture is demonstrated by the "hang" on the bulb test and on the urogram by the slight dilatation of the tract above, and yet at operation for some other lesion gross examination of the ureter may fail to yield definite evidence of stricture. If a preoperative catheterization is done with the same size bulb as that used at the last stricture treatment, and this catheter with its bulb is withdrawn after exposure of the ureter, the assistant who withdraws the catheter can feel the hang of the bulb in the stricture area, and those watching the abdomen can see the tug and straightening of the ureter; yet the infiltration in the ureteral wall may not be sufficiently gross to be certainly palpable with the gloved thumb and finger.

In most cases, however, the infiltration is distinctly palpable. In some instances there is no gross periureteral infiltration. These probably represent the congenital cases of noninflammatory character, in which only slight increase in the muscle and fibrous thickening has taken place. In some cases, although there is visible periureteral infiltration the density of the ureteral walls has not increased sufficiently to be grossly palpable. These probably represent the inflammatory conditions, which could be readily identified as such microscopically if the tissues could be obtained for study.

In most of the cases diagnosed clinically as stricture and later studied at the operating table, we have found undisputed gross evidence of inflammatory changes. Often the peritoneum covering the lesion appears pale white and scarred. Opening and turning back the peritoneum exposes dense periureteral infiltration, frequently accompanied by nodular or diffuse thickening of the ureteral wall. At times the area of nodular thickening is so large and dense that the operator and assistants can scarcely believe that the lumen does not contain a stone.

Opportunities for such gross anatomical studies in approximately one hundred cases explored for other abdominal and pelvic lesions, and for retrograde dilatation in those cases not primarily dilatable by the vesical route, have convinced us from the beginning of this special work that stricture will be found at the postmortem table as soon as the pathologists give this important lesion due consideration. This has been proved by the autopsy studies of Goldstein and Carson (*J. Urol.*, Feb., 1926, 15:155) revealing a 9 per cent incidence of true inflammatory stricture, and another 18 per cent of microscopic inflammatory changes in the lower ureter which had influenced the upper tract but had not progressed to a stage that could be designated as true stricture, as well as by the studies of Schreiber, revealing a 12 per cent incidence of stricture, 5 per cent apparently being of the congenital variety.

Symptoms and Diagnosis.—*General Considerations.*—The symptoms of ureteral stricture are of a more protean character than those associated with any other local disease. The usual location of the stricture is in the lower or pelvic ureter and it is probably the inflammatory involvement of the neighboring nerve trunks and plexuses that accounts for the many referred pains upward into the abdomen and flank regions, posterior to the sacral and sciatic regions, lateral to the hips, and downward to the groin, thighs, legs, and even to the toes.

The downward radiations within the pelvis give rise to annoying bladder, uterine, and rectal symptoms, and the pains referred to the vagina and perineal regions often lead to misdirected operations.

As a result of the urinary stasis we have all grades of damage to the kidneys, with the resultant local and referred renal pains, and widespread general symptoms, such as headache, backache, thoracic pain, fever, malaise, and gastrointestinal discomfort.

In spite of this multiplicity of symptoms the recognition of ureteral stricture is not difficult and a fairly certain diagnosis should be made in most cases by the general practitioner without the aid of the urologist.

The first requisite is to remember that ureteral stricture is one of the most frequent diseases of the abdominopelvic cavity and that it must be considered as a possibility in every diagnosis involving obscure symptoms referable to the lower chest, the back, abdomen, pelvis, hips, and perineal regions.

Ureteral stricture is the first probability for consideration in the patient who presents an abdomen gridded with surgical scars and who is still complaining of the original discomforts, be they of apparent gastro-intestinal, genital, or urinary tract origin.

The more prominent features which lead one to suspect stricture are the complaint of backache, or of pain in the pelvis, and of bladder symptoms. To these leading symptoms the patient often adds the complaint of headache, gastro-intestinal distress, and pains about the hips and down the thighs.

The physical examination is one of the most helpful features of the diagnosis, ureteral stricture practically always being accompanied by tenderness along the urinary tract. If the kidneys can be palpated they are usually tender; if they cannot be palpated the patient generally complains of tenderness in the kidney region. The ureters at the pelvic brim crossing are usually tender, and pressure here often causes a desire to void or discomfort referred to the pelvis which the female patient has usually considered as of "ovarian" origin. If the patient has complained of nausea or of gas discomfort in the epigastrium these symptoms are often elicited by pressure over the ureters at the pelvic brim.

The most constant physical finding is that of tenderness over the ureter in the broad ligament region. One can frequently detect the infiltration here, where pressure usually elicits the desire to void.

Bladder symptoms are present in 75 per cent of ureteral stricture patients

and vary from slight intermittent frequency to complete incontinence. The intermittent spells of frequency may occur at odd intervals, and be ascribed to the menstrual period, to catching cold, to getting the feet wet, or to nervous reaction.

The urinalysis may be helpful in the diagnosis by showing evidence of renal pathology, or it may be most misleading because of its normal character. About 20 per cent of stricture patients have pyelitis and a urinalysis suggestive of this. Fifty per cent show only slight pathology, such as a few leukocytes, a few erythrocytes, a few casts, or albumin in varying amount. Too often in the past such slight evidences of pathology in the urinary tract have been viewed as of no significance and the patient has been referred to the gastro-enterologist, the orthopedist, or the abdominal surgeon for an exploratory laparotomy, in spite of symptoms strongly pointing to trouble in the urinary tract and the urinalysis showing pathology along the tract. About 30 per cent of stricture patients show a negative urinalysis and it is especially in this group that we have previously been misled in our diagnosis.

In the limits of this brief chapter we cannot discuss the many useless abdominal and pelvic operations which as surgeons and gynecologists we have all been doing in our efforts to relieve symptoms due to ureteral stricture, a disease whose frequency and importance have been hitherto unrecognized. Nor can we discuss the present-day urological literature which shows that many surgeons are still following our traditional methods of direct attack on the kidney to relieve conditions due to inadequate ureteral drainage, when far simpler and more efficient methods are at hand.

The close relationship, embryological and anatomical, between the genital and urinary tracts not infrequently results in simultaneous disease of both. Perhaps more frequently the signs and symptoms of disease in the one tract are erroneously referred to the other. The gynecologist must remember that symptoms referred to the urinary tract usually mean disease of that tract. Many disappointments follow the promise to a patient that the bladder symptoms, forming one of her chief complaints, will disappear with the removal of a fibroid, the suspension of a malposed uterus, or the repair of a relaxed vaginal outlet.

The symptoms due to ureteral stricture have led to more misdirected pelvic operations than the symptoms of all other diseases combined.

Because of the high incidence of ureteral stricture the gynecologist should realize that it may be found in association with any genital tract lesion, and he should be equipped to advise the patient with a fair degree of accuracy as to which of her lesions is causing the most symptoms and which should be first treated. Naturally we do not always first treat the disease causing the chief symptoms.

Miss H., aged thirty-five years, was seen in August, 1926, because of menorrhagia and severe backache. Her bleeding was found to be due to an

adenocarcinoma of the fundus. This was removed by panhysterectomy on August 23, and her physician was advised that she would be allowed to return home for convalescence, but she would probably have to return for ureteral dilatations before being relieved of backache. She returned two months later because of the persistence of distressing backache, and bilateral ureteral stricture was found.

Mrs. K. of Portland, Maine, aged sixty-two years, was seen January 7, 1927, complaining chiefly of a backache of many years' duration. She had four children, the youngest thirty-one years of age. Menopause at forty-five, and no discharge since. No bladder symptoms. Physical examination showed much tenderness over both kidneys, over the ureters at the pelvic brim, and in the broad ligament regions. The outlet was relaxed and there was slight rectocele and rather prominent cystocele. The lacerated hypertrophied cervix was the seat of an early epithelioma. Her physician, Walter Tobie, was advised that after destruction of the epithelioma with the tinner's cautery, and a vaginal hysterectomy with repair of the cystocele and rectocele, we would probably have to dilate her ureteral strictures before she would get relief from her chief symptom, backache.

After convalescence of three weeks in the hospital and a week with friends in the city, she returned much depressed because of the persistent backache. Two ureteral dilatations on each side relieved this trouble of so many years' duration, and her outlook on life was completely changed. Formerly, without the ureteral stricture syndrome in mind, this patient would have returned home with great disappointment to all concerned because her imperative gynecologic operation had completely failed to relieve her symptoms.

If the gynecologist finds evidences of ureteral stricture and of a simultaneous genital tract lesion, which is known to be benign and often exists in the absence of symptoms, it is usually the part of wisdom to advise attention to the urologic lesion first, for by so doing the patient's symptoms are often relieved and an operation is avoided.

Dysmenorrhea, one of the most common of all gynecologic complaints, is usually an expression of an obstructive narrowing within the uterus or of inflammatory changes involving the internal genitalia. But all gynecologists of experience know that in many cases of dysmenorrhea there can be found no evidence of inflammatory disease about the genitalia, of malposition of the pelvic organs, of hypoplasia, or of obstructive lesion within the uterus.

Gynecologists frequently see patients with dysmenorrhea who have submitted to several different operations without obtaining relief. It behooves us to bear in mind the possible presence of ureteral stricture in seeking the cause of any dysmenorrhea. In the nosography of ureteral stricture it is rather characteristic that in its early stages in women the pain occurs chiefly and often solely at the time of the menstrual period, or during the period of premenstrual congestion. Later the stricture area becomes so narrow that its

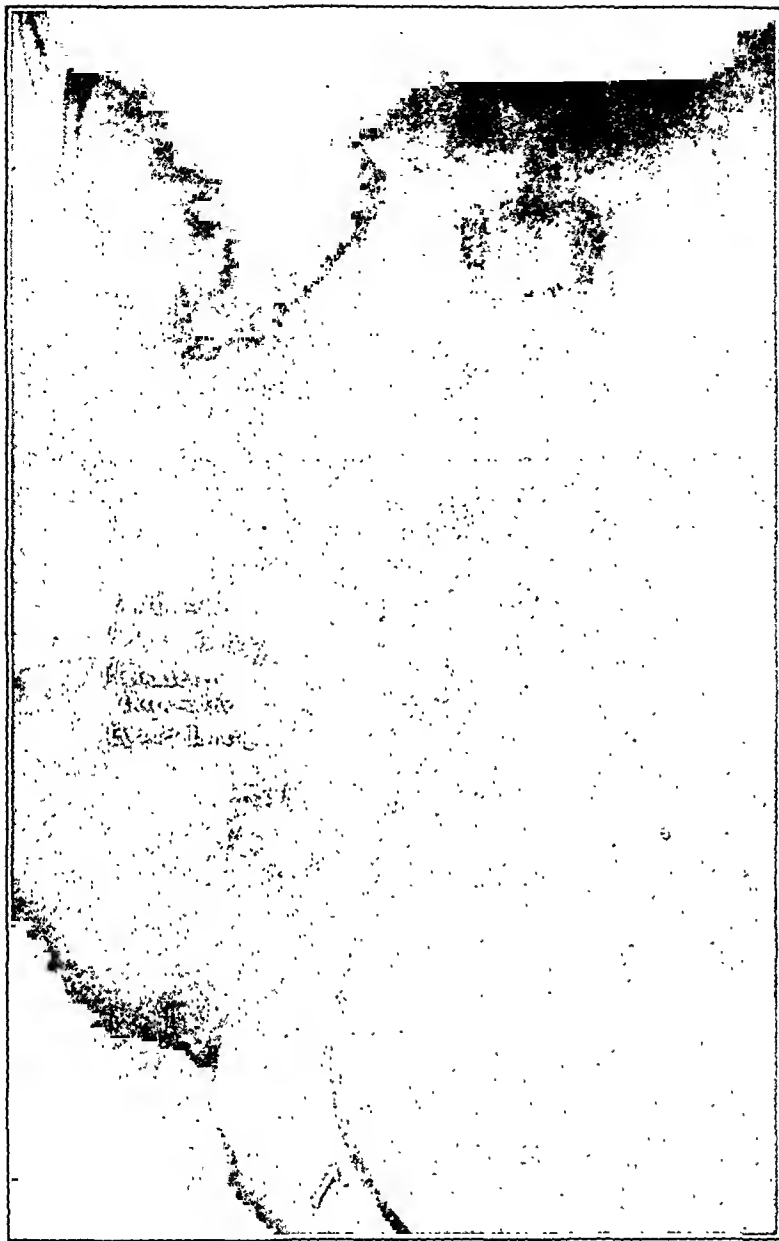


FIG. 714.—UROGRAM IN WOMAN OF 38, WITH DYSMENORRHEA, LEFT “OVARIAN NEURALGIA” OF LONG DURATION, DYSPAREUNIA, AND INVALIDISM FOR ONE YEAR WITH RECURRING RIGHT PYELITIS AND ALMOST CONSTANT BLADDER DISTRESS.

Since measles, at 10, recurrent pain in right flank. Always intolerant of tight clothing. Usually in bed during menstruation, chief pain in lower left quadrant (supposedly ovarian neuralgia), and in upper right quadrant (renal region). Afraid to bear children, dyspareunia causing fear of pelvic disorder.

Bilateral ureteral stricture. Colon bacillus pyonephrosis, right, 37 c.c. content. Left renal pelvis normal, 7-8 c.c. normal urine. Treatment of left ureteral stricture more painful than right, stirring up left “ovarian neuralgia” pain. Gain of 15 pounds in one year, cessation of dysmenorrhea, dyspareunia, and bladder symptoms. Patient rides horse to hounds and is very active in housework and social life.

In addition to the original stricture area in broad ligament region, note long narrow area extending for several centimeters below the kidney, probably ureteritis or periureteritis following the severe pyelitis attacks. Urine pus-free at times; again, showing a few leukocytes. Never entirely free from colon bacilli, probably due to imperfect drainage because of the infiltration in upper ureter.

effects are felt throughout the mouth, to be exaggerated by anything that increases the local congestion, such as the menstrual epoch, becoming chilled, getting the feet wet, overexertion, or a prolonged rough automobile trip.

Points in the patient's history that help us in differentiating ureteral from genital tract dysmenorrhea are as follows: Previous gynecologic operations have not given relief. The dysmenorrhea came on after a year or more of painless periods, and the history and genital tract examination do not suggest a definite cause, Figure 714. The pains began after childbearing. They came on before marriage and have not been relieved by childbearing. For some months or years the pain was monolateral, later becoming bilateral. The pain at first was strictly premenstrual and menstrual but gradually it became continuous, being exaggerated with the period. The "ovarian" pain is accompanied by backache high in the posterior flanks. This backache was at first a menstrual epoch affair, sometimes beginning before the "ovarian" pain set in; later it became more or less continuous. There is considerable general soreness and pain over most of the abdomen, formerly occurring at the menstrual epoch, gradually becoming more or less continuous. There are often associated gastrointestinal symptoms, varying from slight accumulations of gas to much nausea and vomiting, attacks of diarrhea or of mucous colitis. The patient has found that the pressure of corsets or of an abdominal binder cannot be tolerated. The pain in the back is often worse at night and the patient has found it helpful to sleep with a pillow under the flanks or with a flannel blanket over the waistline.

With one or more of the above features in the patient's history there is the additional history of bladder irritation in three-fourths of the stricture cases. This may be one of the chief points stressed by the patient, or we may elicit the bladder history only by careful questioning.

After obtaining a history with many of the above suggestive features we are on guard for the physical examination. The finding of tenderness along the urinary tract with apparently normal pelvic organs should warn us to have the special urologic examination.

If the patient has ureteral rather than genital dysmenorrhea the ureters will be found most tender on palpation of their course through the broad ligament. On palpation here the patient often exclaims, "That is my menstrual pain." This also causes the desire to void if the patient has bladder symptoms. If the patient has had rectal pressure or desire for frequent stools, vaginal pressure pains, or pains of obscure origin in the perineum, these are frequently imitated by pressure on the pelvic ureter.

Ovarian Neuralgia.—One of the common diagnoses of the gynecologist is ovarian neuralgia. Literally quarts of normal ovaries have been removed on this diagnosis. See Figure 715. Every gynecologist of wide experience has made this diagnosis on the strength of the patient's history and on the fact

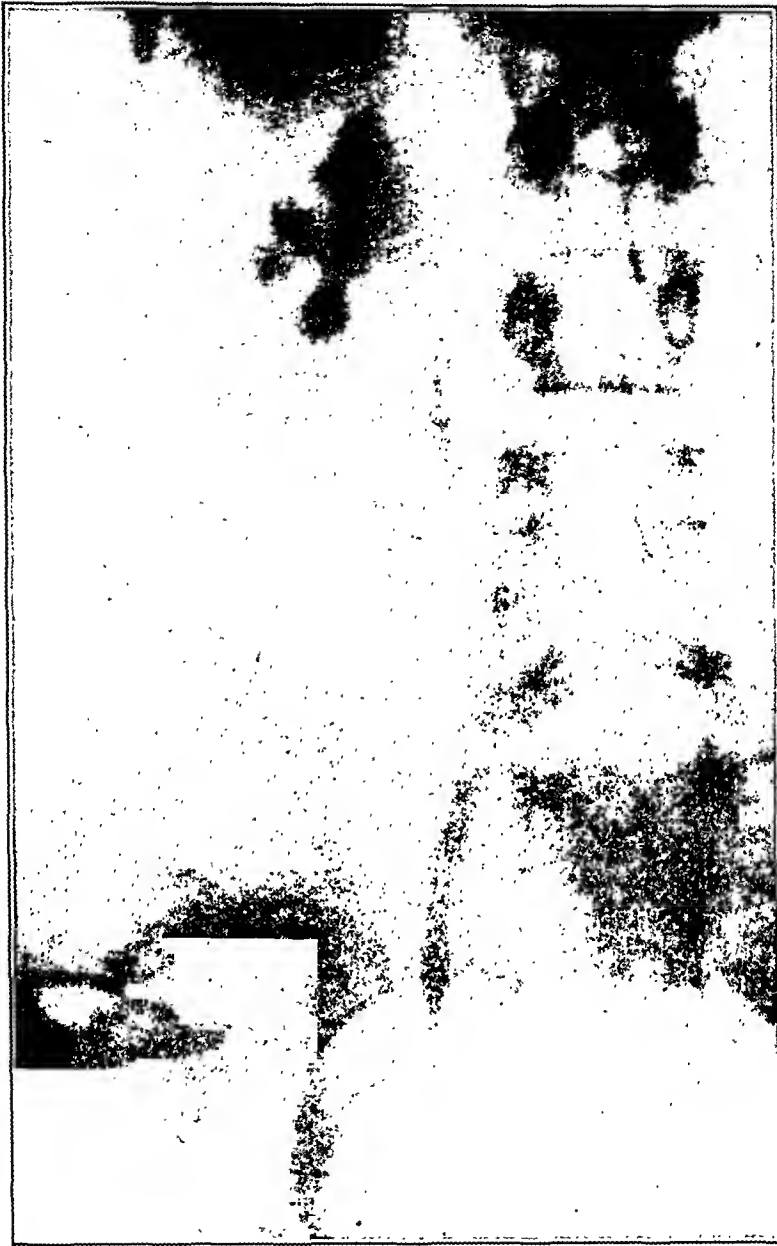


FIG. 715.—PYELOGRAM OF PATIENT (AGE 30) WITH PERSISTENCE OF SYMPTOMS AFTER BILATERAL OÖPHORECTOMY.

Pain for three years in right side, later becoming bilateral with headache, dizziness, shortness of breath, and bladder pain and frequency. Three operations without improvement: (1) Appendectomy and right oöphorectomy. (2) Nature not known; done in seventh month of pregnancy—dead fetus born one month later. (3) Left oöphorectomy. Surgeons decided right kidney was at fault and advised removal. Rapid recovery followed thorough dilatation of bilateral ureteral strictures. Note moderate hydronephrosis (15 c.e.) and hydro-ureter down to stricture area just below pelvic brim.

that the only abnormal physical finding on palpation is an apparently tender ovary. Often when other abnormalities are found, especially malpositions, the gynecologist outlines his intention of operating for the malposition and for the removal of an exceedingly tender ovary. Then at operation the ovary appears so normal that it is left. Subsequently the operator regrets not having removed

the ovary, for the patient's symptoms persist, and the ovary still seems to be the seat of the pain.

The explanation for many cases in this category is that the ovary and a tender ureter are both grasped between the palpating fingers. If one simply bears in mind the possibility of mistaking ureteral for ovarian tenderness he can easily differentiate the two conditions. On bimanual palpation the ureteral region can be avoided and the ovary carried toward the midpelvis and compressed with little or no pain. Then the abdominal hand is left out of action, and with the vaginal palpating finger the broad ligament portion of the ureter can be gently stroked when the patient complains of the characteristic pains. If a doubt still exists the ureter should have a special urologic examination by methods that will reveal stricture if it is present.

Dyspareunia.—Painful coition is an extremely common phenomenon. Because of the patient's modesty and our disinclination to ask about this symptom it is often left out of our gynecologic history when it is playing an important rôle in the patient's ill health. It is not within the province of this chapter to discuss in detail the complicated features of vaginismus and dyspareunia. One can usually elicit from the patient whether her coition discomforts are external or internal. If they are external physical examination usually reveals a cause, or the sexual history points to some reason for a psychic repulsion. If the pain is high up or internal, one sometimes finds a painful scar in the cervix, or more often an inflammatory infiltration of the uterovesical, uterosacral, or broad ligaments, an inflammatory involvement, a tumor, or a displacement of the internal genitalia. The point for emphasis here is that many cases of serious dyspareunia are of urologic origin.

By following the diagnostic methods outlined in the foregoing discussion of ovarian neuralgia, one can usually determine with a fair degree of certainty whether the patient's dyspareunia is chiefly of ureteral origin; when in doubt the therapeutic test is often the deciding factor in the diagnosis. If the ureteral dyspareunia patient has had a history of bladder symptoms she often says that the sexual act is followed by a night of unusual bladder frequency and discomfort. If gastro-intestinal symptoms, such as gas formation, belching, and abdominal tenderness, have been prominent, these are sometimes exaggerated for as much as a twenty-four-hour period after coitus. Not a few patients have given up the sexual life because of painful coition, which was found later to be due to ureteritis, Figure 716. One patient said this led to her divorce.

Descensus.—Gynecologists are familiar with the complaint "falling of the womb," or as some patients express it, "My organs feel as if they are coming down."

Such complaint on the part of a nullipara should at once arouse the suspicion of ureteral stricture. While we see an occasional case of cystocele or of prolapsus uteri in the unmarried and in the nulliparous woman, yet they are exceedingly rare and the physical examination easily confirms the patient's



FIG. 716.—UROGRAM OF PATIENT OF 23 WITH DYSPAREUNIA AND APPARENT ERRORS IN DIAGNOSIS.

Three months after marriage, on honeymoon trip to Europe, severe pain in lower abdomen; walked in flexed posture. Ship physician diagnosed appendicitis and kept her in bed. Appendectomy in London nursing home. Surgeon frankly stated appendix appeared innocent, feared possible salpingitis. Gynecologist in Paris advised hysterectomy. Same advice later by surgeon in Cleveland and by gynecologist in Los Angeles. On admission: fairly well two weeks of month; for a week before period, during four-day period, and for few days afterward, much backache, severe pain in the upper flank region, and feeling of pressure low in pelvis. Intermittent burning on urination and sensation of swelling in bladder. Dyspareunia so severe that intercourse was given up.

Examination revealed general pelvic tenderness which centered over broad ligament portion of ureters, where pressure elicited bladder symptoms and coition pain. Rubin test showed patent tubes. Living baby delivered by cesarean section one year after ureteral dilatation. Note slightly dilated pelvis (10 c.c.) and ureter down to point of sudden narrowing about 4 centimeters above vesical entrance.

complaint. If the complaint is founded on the presence of exceedingly tender ureters, the physical examination fails to show displacement of the genital organs, and if we have the urinary tract in mind we can easily imitate the patient's symptoms by pressure over the tender ureters in the broad ligaments.

We are familiar with the multipara who complains of the typical descensus symptoms, and in some of these patients the prolapsus becomes exaggerated and causes symptoms only after a number of years succeeding childbearing. In such cases the giving away of the pelvic floor has been delayed, and there is frequently a history of sudden strain or trauma, or of prolonged overexertion immediately preceding the final prolapsus.

Our interest here is in the multiparous patient who relates such a typical history, and on physical examination presents a well-preserved pelvic floor and internal genitalia in apparently perfect position. Formerly we managed to find an enlarged cervix, or what we thought was slight descensus, or an overstretched outlet, and proceeded to operation in the hopes of giving relief. We now find that many of these patients simply need urologic treatment.

Menorrhagia.—We occasionally see a patient complaining of menorrhagia in whom the most careful genital tract examination fails to reveal a cause for the excessive bleeding. Such patients often present a definite dyscrasia, the cause being found in their method of living, or in some serious local or constitutional disease revealed by a general physical examination. Ureteral stricture, with its damage to the renal function and the consequent toxemia and influence on the mental, nervous, gastro-intestinal, and other functions, is one of the most fertile causes of a dyscrasia, and not a few cases of menorrhagia have been cured by the restoration of the general health through the establishment of adequate renal drainage. See Figure 717.

Incontinence.—One urologic symptom in which sooner or later all gynecologists are forced to take an interest is that of urinary incontinence. We cannot enter into an exhaustive discussion of this troublesome symptom, but as gynecologists we should know that many patients have not only urinary frequency but actual incontinence because of pathologic changes in the urinary tract due to distant focal infections.

Of over 250 patients complaining of this symptom, the incontinence in a large percentage has apparently been due to impulses arising in ureteral stricture areas, and excellent results have been obtained by treating them on this basis, Figure 718.

Enuresis in children, which persists beyond the first decade, is often due to a focal infection causing an inflammatory lesion in the lower ureters, the trigonum, the urethra, or in this entire region; the urine is usually normal. Removal of the focus of infection cures some cases without urologic treatment. In others a few applications of silver nitrate solution to the reddened trigonum, or dilatation of the urethra, with applications of silver nitrate, are followed by



FIG. 717.—PYELOGRAM OF PATIENT OF 47 WITH MENORRHAGIA PROBABLY INFLUENCED BY UTERINE FIBROID, MENOPAUSAL AGE, OR DYSCRASIA DUE TO URETERAL STRICTURE.

Five years ago, "malarial" fever. Blood negative. Too frequent and too profuse menstrual periods, nausea, furred tongue, bad taste in mouth. Bowels regular. Sent north for better climate. Little improvement.

Examination: small fibroid, 6-7 centimeters diameter. Marked tenderness over kidneys and ureters. Bilateral ureteral stricture, right hydronephrosis 40 c.c., diminished to 30 c.c. at time of pyelogram. Dilatation of strictures resulted in loss of all gastro-intestinal symptoms, gain in weight from 110 to 140 pounds in two years. Periods caused no further serious trouble and ceased within two years.

relief. In still others the inflammation involves the lower ureters which must be dilated before cure is effected.

Cystoscopy.—There may be nothing in the cystoscopic picture to suggest disease in the tract above. On the other hand, one finds in most cases of

ureteral stricture certain changes in the subureteral organs that experience has taught us to associate with stricture.

The external urethral orifice and the para-urethral crypts may show marked reddening, a condition which we formerly ascribed almost exclusively to a previous gonorrheal inflammation, but which we now know may be due as well to a distant focus of infection. On dilating the urethra we find evidences of narrowing in about 85 per cent of ureteral stricture cases. This narrowing may be due to an old gonorrheal inflammation or to senile changes, but in the majority of the patients under discussion it is probably due to a focal infection. It may occur as a diffuse general infiltration of the urethral or periurethral tissues, or as one or more localized annular areas of infiltration. Urethroscopic examination may show a normal or a granular red inflamed mucosa. The striking feature of this examination is that a urethra without evidences of infiltration or stricture may show an angry red mucosa, while the urethra with a more or less dense stricture may show an apparently normal mucosa. The patient with an intensely reddened urethral mucosa may have no bladder symptoms.

The bladder may present a normal mucosa. With a coexisting pyelitis the bladder may or may not be the seat of an inflammatory reaction. One of the most interesting and valuable discoveries in connection with ureteral stricture is that it occurs in about half of our cases of interstitial cystitis, or so-called elusive ulcer of the bladder, and that more than half of the distressing symptoms in an individual with elusive ulcer may be referred from the upper tract, and are relieved by attention to the ureteral strictures while temporarily ignoring the bladder lesion.

The trigonum is frequently the seat of redness and tenderness even though the remainder of the bladder may appear normal. Vesicles over the posterior bladder wall and trigonum are not at all uncommon and there may be marked bullous edema of the trigonum. The ureteral orifice regions may escape the redness and edema seen in the trigonum, but more often the trigonitis extends slightly beyond the ureteral orifices.

In cases without trigonitis the ureteral orifices may appear normal, with thin-lipped slitlike openings. More often the ureteral orifice regions show increased redness, even if the remainder of the bladder and trigonum are normal. There may be only a slight area of increased vascularization just anterior to the orifice, or the orifice may be completely surrounded by a red ring of vessels, the band being one or more millimeters in width. Sometimes the congestion about the orifice is so intense that the opening cannot be seen, and it has to be found by probing with the metal searcher or the catheter tip. Not infrequently there is a brilliant red or a pale edematous papular elevation immediately in front of or near the orifice.

The orifice often shows evidence of tissue infiltration changing its form from the slitlike ellipse to a perfectly round opening. The infiltrated lips may

be slightly retracted, on the mucosa level, or slightly elevated as a pale white scarlike ring. Leukoplakia vesicæ is usually described as a rare lesion, but one often sees in these cases a white elevated patch of epithelium near the ureteral orifice or the typical maple leaf figures over the trigonum.

Our interpretation of the foregoing gynecologic and cystoscopic changes so often seen in cases of ureteral stricture is that the focal infection, which so often invades the broad ligament regions and involves the lower ends of the ureters, also frequently involves the tissues about the base of the bladder, trigonum, and urethra, sometimes including the vertex region of the bladder (elusive ulcer), and even the tissues about the vulva.

Those who do urological work for both sexes will probably depend largely on the Nitze type of cystoscope and water distention of the bladder. For those who do a large volume of work on women there are many arguments in favor of the use of the Kelly endoscope and air distention of the bladder. One of the most common arguments against this method is that the knee-chest posture is distasteful to the patient. The first reply is that the lithotomy position is quite as distasteful, and many patients who have been subjected to both methods prefer the Kelly method, largely because of its rapidity of execution.

Other arguments in its favor are the ease with which lesions in the bladder are treated locally with various drugs (in solution or in the crystal state) or with the actual cautery, high frequency current, or implantation of radium seeds. For the prolonged application of radium tubes the special instruments are more easily applied through the Nitze type of cystoscope with the patient in the dorsal position.

Since the discovery of the important rôle of ureteral stricture in many of our more common renal diseases, the advantages of the Kelly cystoscope are more appreciated than ever before.

Stricture can be studied and treated with the bulbed catheter used in the Nitze type of cystoscope by the method of Goldstein, who places the bulb within 2 or 3 centimeters of the catheter tip, introduces the catheter and bulb in the bladder, and then retrogrades the catheter through the cystoscope as this enters the bladder. By this method one is restricted in the size of the bulbs used, a 14 French being about the limit. This gives sufficient dilatation and drainage in many stricture cases, but the majority need wider dilatation for permanent results.

McCarthy's foroblique endoscope allows of the passage of bulbs up to 17 French and this instrument is becoming increasingly useful, particularly in ureteral stricture work in the male.

The Kelly endoscope simplifies ureteral stricture work in women to the last degree, and the size of the bulb used is limited only by the practical considerations of the relatively small size of the ureteral lumen. See Figures 719 and 720. In order to induce some large ureteral stones to pass spontaneously we have gradually carried the bulbs up to 8 millimeters diameter, 24 French.

In some obstinate strictures we have gradually dilated to a 7 millimeters, 21 French bulb, and many cases need as high as a 6 millimeters bulb before permanent results are obtained. Cases that call for such high dilatation are likely to require repeated treatments at six- or twelve-month intervals because of the tendency of dense strictures to contract again and cause symptoms.

Bilateral strictures should never be treated at the same sitting. It is best to allow at least forty-eight hours between the dilatation of the two sides, and the individual ureter should never be dilated at less than ten-day intervals. When one has reached the larger bulbs, two or three weeks should intervene between treatments, so that all traumatic irritation and swelling may subside.

One must at all times bear in mind the delicate structure of the ureter and the ease with which its walls may be punctured. With the larger bulbs on the No. 8 or No. 9 catheter, a heavy wire stilet is used, and this sometimes fails to take the natural curves of the ureter, and tends to advance in a straight line, which, with unlimited pushing force, would carry the stilet point through both catheter and ureteral wall. As these large catheters enter the ureter and an obstruction is met, the stilet should be withdrawn an inch or two with each equal advance of the catheter. If unusual force has been used to advance the catheter to the kidney one should always wait until the urine flows before testing the size of the pelvis or introducing urogram fluid for an x-ray. There is often a temporary anuria of a few minutes, due probably to the individual nervous excitability and spastic contraction of the kidney. This anuria may last a half hour before the kidney relaxes and begins secreting. One waits a half hour if he is particularly desirous of getting a specimen and culture or measuring the capacity of the pelvis, or getting an x-ray or bilateral functional test, but if at the end of this time there is no flow from the kidney, in spite of the ingestion of several glasses of water, and particularly if the opposite kidney is sending urine through the bladder, it is wiser to conclude that the catheter has punctured the tract, and to withdraw it without attempting an injection of any kind.

Spiral wax-tip



Wax

FIG. 719.—SPIRAL OR CORKSCREW WAX TIP OFTEN TRAVERSES STRICTURE AREAS IMPERVIOUS TO SMALLER FILIFORMS OR POINTED TIP CATHETERS.

Usually molded to catheter 10 centimeters back of tip; if urogram shows narrow areas in upper ureter (Figure 714), bulb is placed immediately back of tip.

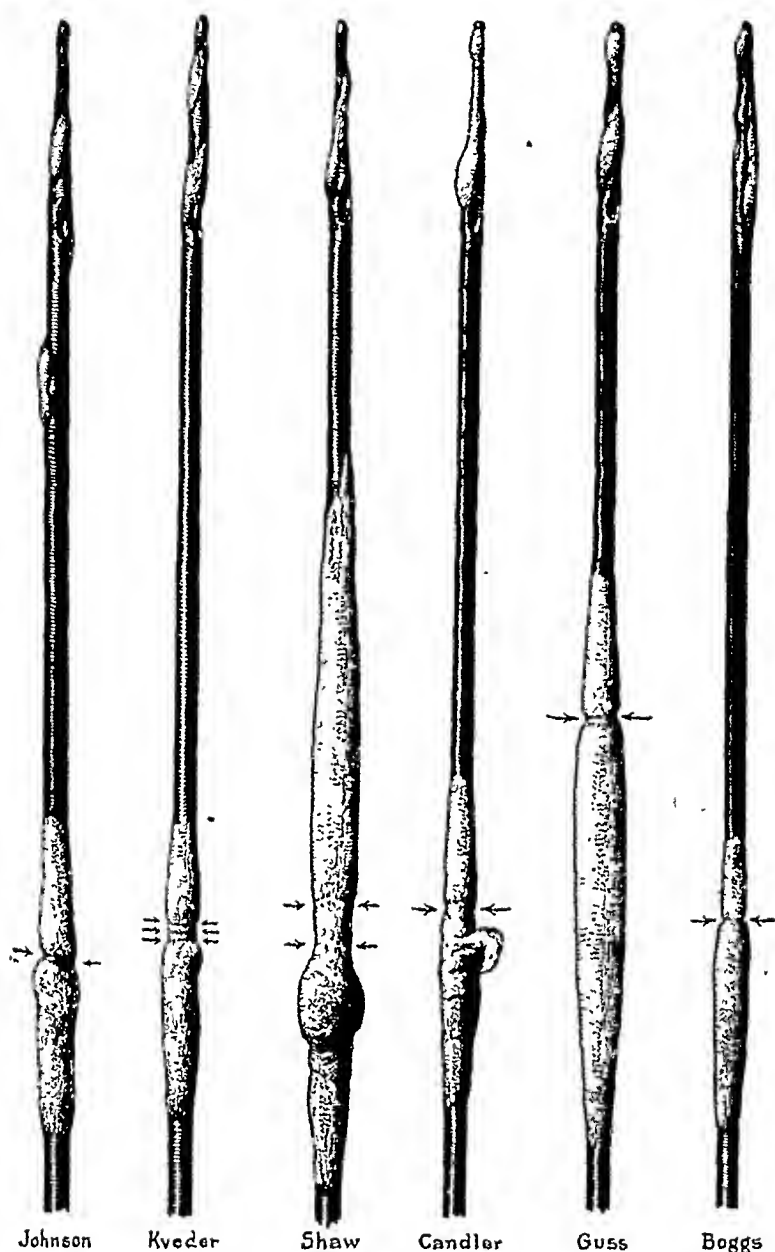


FIG. 720.—BULBS ILLUSTRATING EFFECTS OF STRICTURE ON PLIABLE WAX WHEN BULB IS TOO LARGE TO PASS ENTIRELY THROUGH.

A spindle-shaped bulb meeting an unusually dense stricture is often molded back uniformly, and clears the stricture, coming back a cylindrical shaped bulb of lesser caliber.

Johnson—4.6 millimeters wax bulb blocked in upper of two strictures, about 11 centimeters above bladder. Wax slightly molded back in entire circumference; indented as if by a string.

Kveder—At first treatment of right ureter 4.5 millimeters bulb obstructed 3 centimeters above bladder, hung firmly on withdrawal; distal shoulder of wax heaped back on one side; note three tiny stringlike parallel marks in its compressed area.

Shaw—Fourth treatment left side; bulb about 5.6 millimeters passes great obstruction until almost through stricture, where it is stopped permanently by heaped-up wax. Imprint of stricture distal to heaped-up portion. On withdrawal stricture hang felt 7 centimeters from external orifice or 2 centimeters above bladder.

Candler—Wax bulk dissected back by dense ureteral os leaving stricture imprint in circumference of wax distal to dissected shoulder. Obstruction 2-3 centimeters above bladder.

Guss—Fifth treatment; 6 millimeters bulb obstructs 4 centimeters above bladder.

Boggs—First treatment; 3.6 millimeters bulb completely obstructed 3 centimeters above bladder.

(Drawings by Max Brödel.)

In ureteral catheterization in the past ten years, estimated in number as well over twenty thousand, Hunner knows of about a half dozen perforations in his own hands, and of about an equal number in the hands of his assistants.

Treatment.—The treatment of ureteral stricture consists in such thorough dilatation of the narrowed ureteral lumen that adequate renal drainage is established. If the stricture is of the acquired variety and, as is so often the case, due to a focal infection, one cannot look for a permanent cure if the focus of infection is not eliminated. In this era of attention to focal infections as a possible relief for all sorts of obscure complaints, many of our ureteral stricture patients have had possible foci treated before the discovery of the stricture.

The chief cause of failure to relieve stricture symptoms as seen in those patients who come to us after one or more courses of stricture treatments elsewhere, is found to be inadequate dilatation.

As already stated in discussing technique, those who are limited to the use of the Nitze type of instrument are not able to employ sufficiently large bulbs to give permanent relief in many of their cases. Some urologists arrive at excellent results by passing multiple catheters of increasing sizes through the Nitze type of instrument. In our own work we are sometimes disappointed in results after getting the strictures in the lower ureter well-dilated, and on reviewing our urograms we find evidences of a narrow area in the upper ureter. By placing the bulb near the tip of the catheter we find in some of these cases that there is actual stricture in the upper ureter, and our former dilatations with the bulb 10 centimeters back of the catheter tip has affected the high stricture only by the dilatation given with our No. 9 catheter. By gradually increasing the size of the bulb placed near the catheter tip and making certain, by touch, and by urogram if necessary, that our bulbs are going entirely into the kidney pelvis, we finally obtain good results.

In a few cases our thorough dilatation of stricture areas has given only partial relief and we have been forced to operate for the secondary pathologic conditions which have developed in or near the kidney. It is astonishing how many patients with large hydronephrosis, even when there is considerable mobility and descent of the kidney, become free from symptoms after thorough dilatation of the original stricture obstruction. At times, however, we must operate on such patients to resect an unusually large pelvis, or to make a plastic enlargement of the pelviureteral opening, or to free perirenal and periureteral adhesions, and make a high fixation of the kidney. In such instances our preliminary ureteral dilatations have been necessary to insure the good results of the delayed operation.

In rare instances we are unable to get a fine whalebone filiform or any kind of dilator to pass the stricture area from below. In most of these an extraperitoneal exposure of the ureter through a low McBurney incision enables

us to pass increasing sizes of bougies from above downward. This retrograde opening of a stricture area should always be followed for a time with repeated dilatations by the vesical route.

In cases of failure to pass dilators by the retrograde route we are forced to do a nephrectomy, or, in the patient who has but the one kidney or is known to have a kidney of very low function on the opposite side, we can perform

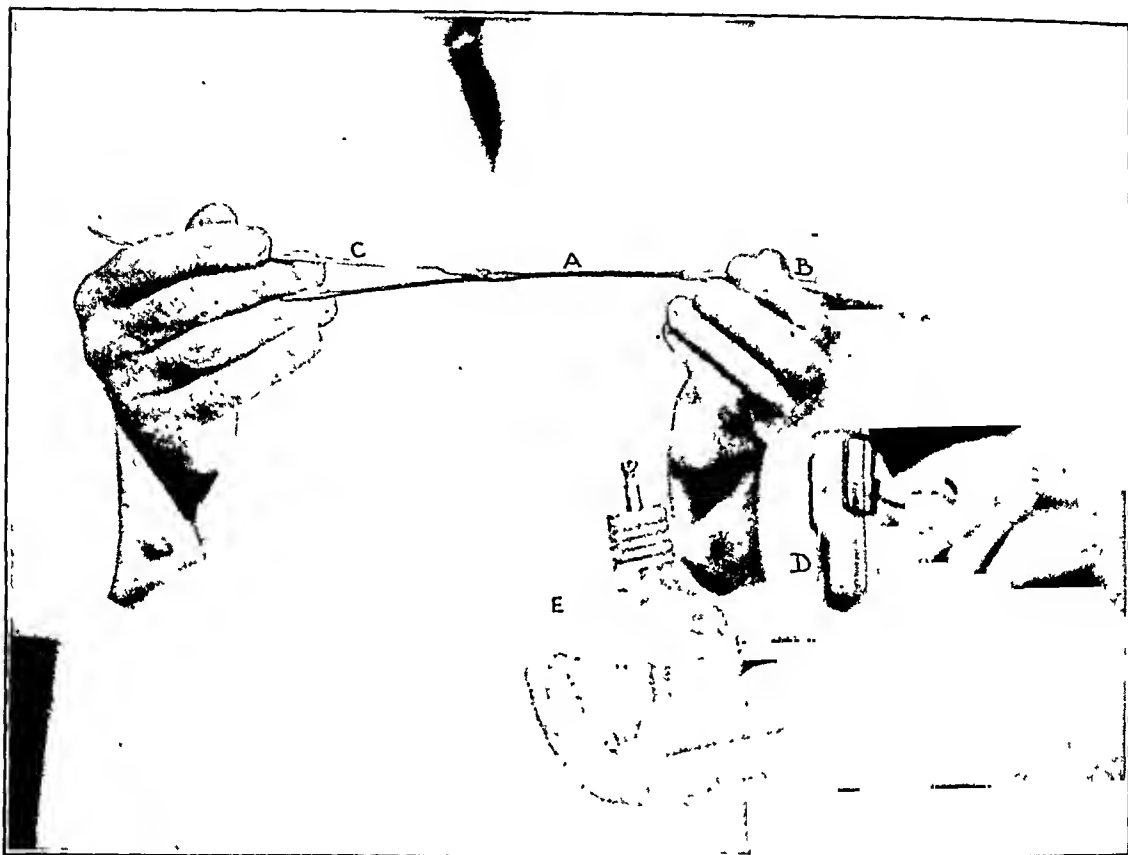


FIG. 721.—METHOD OF MAKING WAX BULB.

- A. Renal catheter 50 centimeters long stiffened by copper wire stilet.
- B. Sterile rubber sleeve, about 10 centimeters long; large lumen allows it to slip along catheter easily and permits manipulations of catheter with unsterile hands.
- C. Long-handled metal spoon used by dentists handling melted wax.
- D. Test-tube for melting wax—short and wide to permit introduction of spoon or curved heated artery forceps in building up wax mass on catheter. Crude beeswax is ideal material for bulbs.
- E. Alcohol lamp to keep wax fluid and to heat spoon or other type of ladle. In a large clinic, a small electric hot water-bath receives test-tube between treatments, keeping wax fluid.

ureterosigmoid anastomosis or bring the ureter to the skin surface in a position for convenient permanent tube drainage to a rubber sac worn on the upper thigh.

By the early recognition of the signs and symptoms of ureteral stricture, and by early and thorough treatment, the gynecologist of the future will exert a most important prophylactic influence on many of the so-called surgical diseases of the kidney in women. By his ability to recognize those cases that have been

neglected until serious symptoms have developed he will be able to avoid many serious abdominal and pelvic operations, and save the patient much economic waste in rest cures and other fruitless methods of treatment, resorting at once to those comparatively simple methods of treatment which alone can help the patient.

CHAPTER XLII

TUMORS OF THE BLADDER

CURTIS F. BURNAM AND WILLIAM NEILL

CLASSIFICATION

ETIOLOGY

FREQUENCY

AGE

SEX

PATHOLOGY

Papilloma

Adenoma

Cysts

Carcinoma

Adenocarcinoma

Sarcoma

Myxoma

Angioma

Myoma

In Children: Some Rare Heterotopic Tumors

SYMPTOMS

DIAGNOSIS

TREATMENT

Surgery

SUPRAPUBIC EXTRAPERITONEAL CYSTOSTOMY

TRANSPERITONEAL CYSTOSTOMY

TOTAL EXTIRPATION

Surgical Endothermy

Radium

X-Ray

RESULTS OF TREATMENT

Papilloma

Carcinoma

Sarcoma

Myxoma

Angioma

Myoma

CONCLUSIONS

Ancient writers either failed to recognize or attached but little importance to bladder tumors, for the literature is void up to some brief reports in the fifteenth century, and the more pretentious treatise of Lacuna in 1551. Chopart, 1791, recognized and emphasized the importance of hematuria as a symptom and diagnostic sign. Civiale, 1843, distinguished bladder tumors as benign and malignant, with clear pathological descriptions. Bardenheuer, 1887, recommended and performed complete extirpation of the bladder for cancer. Trendelenburg greatly advanced the surgery of the bladder, his chief contribution being the posture known by his name, and the extraperitoneal transverse incision. Harrington, 1893, boldly operated transperitoneally but his method received no general acceptance until used by Judd (*Tumors of the Urinary Bladder: A Study of 114 Cases*, Collected papers of the Mayo Clinic, 1912, Vol. IV) with subsequent numerous contributions relating both to the technique and the results of this method.

The first transurethral, endovesical methods dating from Nitze in 1896, record a series of cures never since duplicated. While honor is due him for his pioneer work in developing the cystoscope, his recorded cures are gravely questioned.

Edward Beer and Eugene Doyen, 1910, introduced high frequency, fulguration, and electrical cauterization into this field, and Kelly used radium as early as 1910. In the last two decades, *pari passu* with the advances of cystoscopy, surgery, new applications of electricity ("diathermy," "endothermy"), radium (applied intra- or extra-vesically), and x-ray, the diagnosis, histological classification, and new means entailing superior results in the treatment of bladder tumors have been evolved.

Classification.—Primary tumors begin in the bladder and originate in the component tissues of the organ; the common secondary tumors are due either to direct extension from contiguous parts, or to metastases from a distance, rarely recognized in life and rarely demanding treatment, the chief interest being at the autopsy table and in statistics. Secondary cancer by extension, particularly from the prostate gland and the uterus, often simulates primary vesical cancer, and frequently demands the same treatment accorded primary cancer.

A malignant tumor may spread from any part of the pelvis into the bladder, those of the prostate gland being the commonest. Montefort, in seventy-eight apparently primary tumors of the bladder, found that 35 per cent were really prostatic. Next in frequency come those of the uterine cervix, the vagina, the body of the uterus, the ovaries, the bowel, the seminal vesicles, and the urethra, as primary foci.

The classification of vesical growths by Albarran and by Küster is satisfactory and is adopted here, resting as it does on a judicious combination of histogenetic, gross and microscopic, morphologic, and biologic differences:

1. Epithelial tumors
 - (a) Papilloma, benign and malignant
 - (b) Adenoma
 - (c) Cysts
 - (d) Cancers, papillary and scirrhus, squamous, adenomatous
2. Connective-tissue tumors
 - (a) Sarcoma
 - (b) Myxoma
 - (c) Fibromyoma
 - (d) Fibroma
 - (e) Angioma
3. Muscular tumors
Myoma
4. Heterotopic tumors
 - (a) Rhabdomyoma
 - (b) Hydatid cysts
 - (c) Dermoid cysts
 - (d) Chondroma
 - (e) Cholesteatoma

A. C. Broders (*Ann. Surg.*, 1922, 75) stimulated new interest and enthusiasm in the whole question of bladder tumors, by forcibly emphasizing, first, the well-known and acknowledged dogma that the best results are to be expected in the cases treated early, while the tumors are yet small, and, second, that the results also depend upon the degree of histologic malignancy. He separated the tumors with this in view into ascending grades. In Grade I, only 25 per cent of the cells are, microscopically, active malignant; in Grade II, 50 per cent; in Grade III, 75 per cent; and in Grade IV, approximately 100 per cent.

Certain authors are now inclined to base their prognosis and even to determine their methods of procedure upon the histological pictures. It is evident from Broders's report that he felt that the gross and the microscopic pathology must be considered together to reach a final judgment. While we find that a consideration of Broders's gradations is important, we have nevertheless lost patients in Grade I, and saved others in Grade IV, and some in Grade I have extended rapidly, while others in Grade IV have been markedly slowly progressive.

One notes a growing tendency to classify most vesical tumors as either actively or potentially malignant, some even going so far as to reckon all malignant. F. S. Watson (*Ann. Surg.*, 1905, 42) in 653 cases found 410 were malignant. Von Frisch (*Wien. klin. Wchnschr.*, 1907, 20) concluded from

his series of three hundred operative cases that two-thirds were malignant. J. T. Geraghty (Cabot, *Modern Urology*, 1918, Vol. II) states that 68 per cent of those seen in the Brady Urological Institute (Johns Hopkins Hospital) were malignant. Lower (*Ann. Surg.*, 1922, 76) reports about 50 per cent malignant. B. S. Barringer (*Ann. Surg.*, 1921, 74) in fifty-three cases found forty-six were malignant or about 86 per cent. In 186 cases at the Howard A. Kelly Hospital, the percentage of malignancy has been approximately 90.3 per cent.

Etiology.—The provocative cause of neoplasms is as little known here as elsewhere. It is quite clearly, however, occupational in the aniline dye workers.

Frequency.—We possess no satisfactory statistics for an accurate estimation either of frequency in proportion to population or in relation to tumors in general. Hadda (*Langenbeck's Arch. f. klin. Chir.*, 88) estimated that 0.25 per cent of all cancer begins in the bladder; it is safe to reckon the percentage as within 1 per cent. An apparent clinical increase is doubtless due to a growing interest in this field and a wider use of the cystoscope.

Age.—In von Frisch's series of three hundred cases, three occurred in children between nine and thirteen, nine were in adults between twenty and thirty, twenty were between thirty and forty, seventy between forty and fifty, seventy-six between fifty and sixty, one hundred and twelve between sixty and seventy, and ten between seventy and seventy-nine. In 212 seen at the Howard A. Kelly Hospital, the numbers according to age were:

<i>Years</i>	<i>Malignant Cases</i>	<i>Years</i>	<i>Benign Cases</i>
20 to 30 (youngest 26)	2	20 to 30 (age, 24)	1
30 to 40	13	30 to 40	3
40 to 50	30	40 to 50	6
50 to 60	44	50 to 60	5
60 to 70	71	60 to 70	6
70 to 80	22	70 to 80	2
80 to 90 (oldest 86)	5	80 to 90	1
		90 to 100 (age, 91)	1
	187		25

The average in the malignant group was fifty-nine years, and in the benign, fifty-three years.

The literature contains records from two to eighty years. For epithelial tumors, the age of greatest frequency is between forty and seventy. The sarcomata are much commoner in children.

Sex.—Vesical tumors are much commoner in males than in females. An average of reported statistics gives about four men to one woman. Von Frisch, for example, found in 300 cases, 256 males and 44 females. Our own series is exceptional, doubtless because we see more gynecological than male urology. In our series of 186 vesical tumors treated, 67 were men and 119 women.

Pathology.—The autopsy appearances, as well as the cystoscopic pictures, are various. It is practically impossible by a naked eye inspection to distinguish the various microscopic groups; it is often difficult and even impossible to determine whether malignant or not. It is therefore convenient pathologically to treat each class separately.

The epithelial tumors are divided for convenience into (*a*) benign papilloma, the noninfiltrating papillary growth, histologically closely resembling the epithelium of the normal bladder mucosa; (*b*) malignant papilloma, noninfiltrat-



FIG. 722.—PAPILLOMATOUS TUMOR OF BLADDER; TIPS OF PAPILLÆ AND FINGERLIKE PROLONGATIONS.

Small blood-vessel in center of papilla forms framework on which epithelial covering is built up. $\times 135$.

ing, but histologically presenting such malignant features in the cells as irregular mitoses, clumped and deep-staining chromatin masses, and irregularity of size and arrangement of layers of cells; (*c*) papillary carcinoma, presenting the additional feature of infiltration; (*d*) the infiltrating carcinoma which, while invasive, has no intravesical papillary form. Microscopically, there are several different cancers of the infiltrating type.

Papilloma.—Simple papillomata and papillary carcinoma form the majority of bladder tumors; the former are much less frequent than the latter. In 186 papillomata of Burnam and Neill, the benign form occurred but eighteen times, malignant papilloma occurred twenty-two times, papillary carcinoma eighty-eight times, and infiltrating carcinoma fifty-eight times.

A papilloma may be pedunculate or sessile. It is often made up of numerous, delicate branching strands, through a water cystoscope looking like seaweed, floating up from the ocean bottom; sometimes they are rounded, solid, nodulated, or muriform; often they are multiple. Geraghty, in his series, found that 34 per cent of the tumors were multiple. Occasionally the entire bladder is covered (two in our eighteen cases). Common sites are the urethral and the ureteral orifices. The area behind the trigonum is also often involved.

In simple papilloma the deeper tissues of the bladder are not implicated. Usually soft and friable, it is occasionally fibrous, tough, hard.

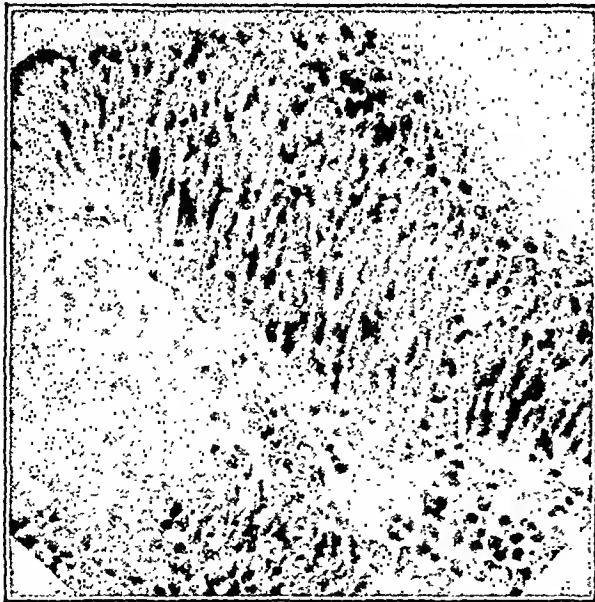


FIG. 724.—MALIGNANT PAPILLOMA.

General arrangement still that of benign papilloma. Malignant changes in evidence, particularly in cells near stroma strand. (*Am. J. Roentgenol. & Rad. Therap.*)

strained cancer cells is demonstrable; with the progressive infiltration, the invasion can be detected by palpation as well as by the gross appearances, Figure 724.

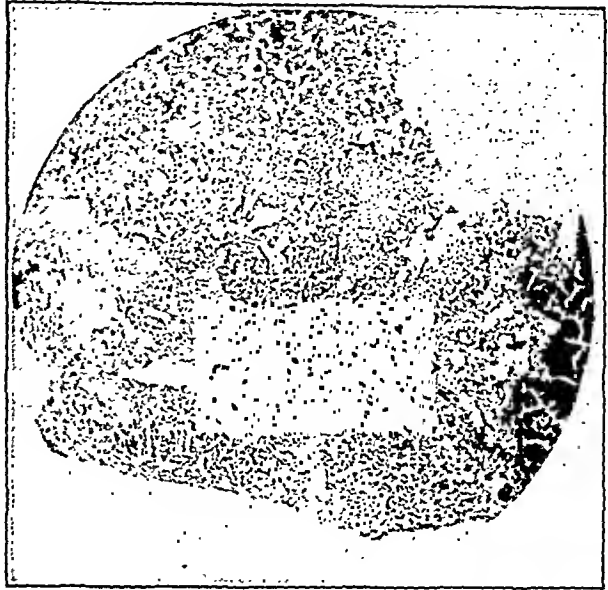


FIG. 723.—PAPILLARY CARCINOMA.

Note disappearance of orderly arrangement, great irregularity in size and staining of cells, and especially chromatin clumps of nuclear material. (*Am. J. Roentgenol. & Rad. Therap.*)

Microscopically, Figure 722, there is a central strand of connective tissue carrying the vessels, over which the epithelium appears in regular layers, similar to the normal vesical epithelium.

Foerster, in 1855, first noticed the transformation of benign into malignant papillomata, change of the well-ordered epithelial layers into irregular heaps, and the still more characteristic alterations in the cell nuclei; there are also numerous mitoses and a clumping of deeply stained chromatin material, Figure 723.

If the change is at the base of the pedicle, the invasion of the normal bladder tissues by the unre-

There is a strong tendency of simple papillomata to become malignant, and it is common to find one part histologically benign and another malignant, but there is no greater tendency for the base to become malignant than any other area. Benign tumors remain localized in the bladder, while the malignant spread by infiltration or by metastasis. It is, however, possible for a large, malignant tumor, when found, still to be limited to the bladder, while it is also not infrequent for a small one to metastasize early to glands or distant viscera.

Adenoma.—Collected statistics show that adenomata are rare. Watson observed two in his series of 653; Geraghty two cases in 180. Leguen (*Traité chirurgical d'urologie*), cites twelve cases in all. In the series of Burnam and Neill, from the Kelly Hospital, there was not one.

Such tumors are usually small, solitary, soft, vascular, and entirely submucous, although microscopically there is often a communication with the cavity of the bladder by the tubules.

Adenomata are commonest in the trigonal region, where the glands of Limbeck and Brum, present in all parts of the bladder, are more abundant. The epithelial lining is usually in a single layer but may be sometimes multiple.

Cysts.—The rare cysts are of two sorts: (1) multiple small cysts, and (2) solitary large cysts. The former are usually associated with cystitis, resulting from an epithelial proliferation with subsequent colloid degeneration, a condition sometimes called cystitis cystica. The large cysts, usually single, and likely to appear near the urethral orifice, spring from the glands of Limbeck and Brum and attain the size of a walnut or larger. Such a cyst has two layers of epithelium and is usually thin-walled and clear, and by cystoscopy translumination is possible. Dermoid cysts are rarely if ever primary, although not uncommonly arising from the ovary or the prevesical space.

Carcinoma.—The gross and microscopic features of cancer of the bladder vary greatly, depending on the size, location, and type of tumor. Usually they are soft, but not infrequently with a superabundance of connective tissue the growth is very hard. We have already spoken of the malignant papillomata, essentially cancers of the papillary type, and have mentioned the rare adenocarcinomata. In addition to these there are tumors, partly papillary, which from the outset tend to infiltrate the bladder walls, which are clinically papillary carcinomata. Those not infiltrating are the malignant papillomata. There is also the flat, infiltrating carcinoma, which in its beginning may be limited to a very small area; later on a large part of the bladder is infiltrated. Adenocarcinoma is usually infiltrating.

Most of the infiltrating carcinomata are histologically of the same cell type as the papillary tumors, but why the tendency to form papillary masses is lost is not clear.

A rare, interesting type of infiltrating carcinoma, usually beginning in patches of a vascular leukoplakia, is a squamous cell epithelioma. Geraghty

reports one case; Scholl (*Arch. Surg.*, 1921, 3), six cases. A splendid consideration of the subject, with report of three personal observations cured by operation, comes from F. E. Hinman and Thomas Gibson (*J. Urol.*, 1921, 6) who collected eighty-seven from the literature. Where sex was noted, the proportions were three males to one female. Metastases were recorded definitely in but nine cases. The histological picture is similar to a squamous cell epithelioma of the cervix uteri; epithelial pearls and whorl formations are common. Leukoplakia in the bladder is an interesting phenomenon. It is not



FIG. 725.—SQUAMOUS-CELL CARCINOMA DEVELOPING ON EXSTROPHY OF BLADDER. $\times 68$.

clear whether it is metaplastic or heterotopic from misplaced epithelial tissue. H. L. Kretschmer (*Surg., Gynec., & Obst.*, 1920, 31) covers the question of leukoplakia of the bladder and ureters thoroughly.

Adenocarcinoma of the bladder is rare. We have seen but one instance. Geraghty reports two cases, and A. J. Scholl, Jr. (*Surg., Gynec., & Obst.*, 1922, 34) reports five cases in 262 from the Mayo Clinic.

B. S. Barringer (*Surg., Gynec., & Obst.*, 1920, 30) observed a colloid adenocarcinoma; there has been a tendency to question its occurrence in the bladder but it is noted several times in the literature.

Sarcoma.—Sarcomata of the bladder are happily comparatively rare—Watson fifty-two cases, J. A. Gardner (*Ann. Surg.*, 1915, 62) seven cases, Geraghty two cases, Scholl (*Surg., Gynec., & Obst.*, 1922, 34) one case, and

we have seen two. Most of those reported have been round or spindle-celled. Mixed cell tumors, however, have been seen, and Bencke and W. Fisher (*Virchow's Arch.*, 161) observed an osteochondrosarcoma. While no age is immune, they are commoner in adults than in children, but constitute a considerably larger proportion of malignant tumors in children than in adults. Albarran, in fifty-three cases, found 10 per cent in patients under ten years. The symptoms are those of cancer; metastasis and invasion by direct extension are the rule. Cystoscopic appearances are similar to cancer. There is much less likelihood, however, of ulceration. Pain is also apt to be pronounced.



FIG. 726.—RARE ADENOCARCINOMA DEVELOPED FROM GLANDS OF LIMBECK AND BRUM.

(*Am. J. Roentgenol. & Rad. Therap.*)

1851) described an angioma of the bladder. Its rarity is evidenced by only two in Watson's series, by Albarran's (*Les tumeurs de la vessie*, 1892) one, and Scholl's (*Surg., Gynec., & Obst.*, 1922, 34) three cases. Most of those reported are in adults. The most pronounced symptom is hemorrhage; as a rule, the cystoscopic appearance is characteristic of angioma. The tumors are generally small.

Myoma.—Myomata are rare and originate in the muscular tissue of the bladder, resembling myomata of the uterus. The amount of fibrous tissue present varies so greatly that the consistency may be hard or soft. According to their location, they are submucous, interstitial, or peripheral. There are sixteen in Watson's series. Occasionally, as in one of Kouznetzki's (*Ann. d. mal. d. org. génito-urin.*, 1909, 27) they attain great size, his tumor weighing 9 kilograms. Both sexes are affected about alike, and are mostly adults. There is a marked tendency towards malignancy. Bleeding is usually pronounced.

Myxoma.—Myxomata and fibromyxomata are rare, frequently multiple, and sometimes of great size. The tendency to malignant degeneration is marked. They are commoner in childhood and may even be present at birth. Some idea of the frequency is afforded by the statistics of Watson, sixteen, and Scholl (*Surg., Gynec., & Obst.*, 1922, 34), two cases. We have not seen a tumor of this sort. In addition to the usual symptoms of the malignant bladder tumors, there is superadded a pronounced tendency to obstruction.

Angioma.—Gross (*Practical Treatise on the Urinary Organs*,

In Children: Some Rare Heterotopic Tumors.—Tumors of the bladder in children are rare and nearly all are of connective-tissue or heterotopic origin. G. Hüsler (*Jahrb. f. Kinderheilk.*, 1905, 62) collected a total of fourteen from the literature: six sarcomata, one fibroma, one fibro-adenoma, one myxoma, two rhabdomyomata, one mixed tumor containing cartilage, one undiagnosed, and finally a single papilloma.

Hüsler and R. F. Muller (*Jahrb. f. Kinderheilk.*, 1905, 62) believe that the mixed tumors have their origin in teratomata. Rhabdomyoma is well

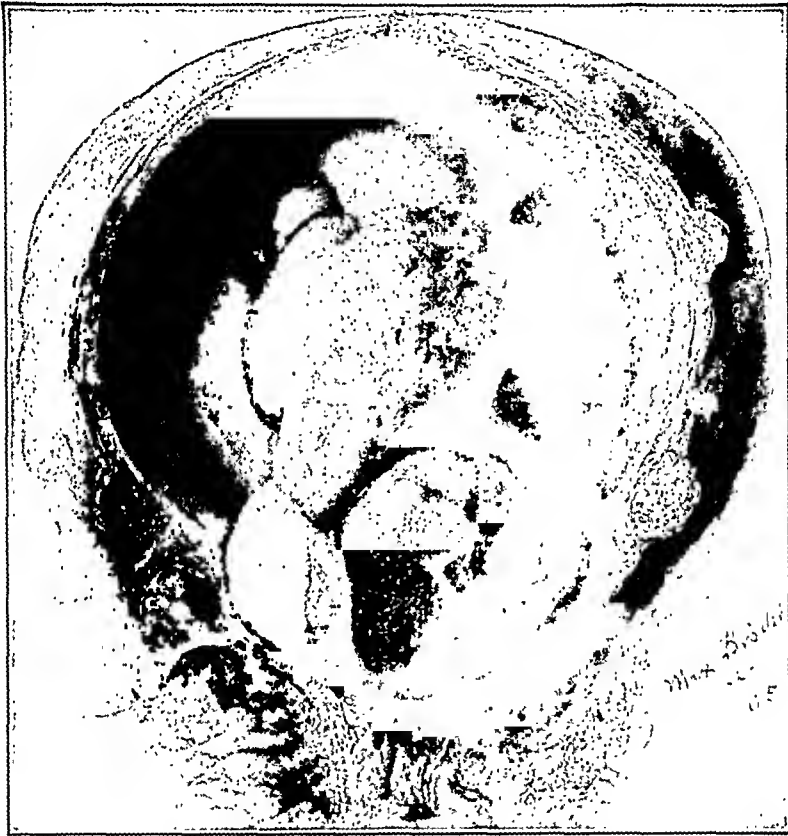


FIG. 727.—RHABDOMYOSARCOMA IN GIRL OF TWELVE.
(Claribel Cone.)

described and illustrated by Kelly and Burnam (*Diseases of the Kidneys, Ureters, and Bladder*). A case was studied and reported by Claribel Cone, as observed in a twelve-year-old girl. Monckberg (*Virchow's Arch.*, 187) also describes it.

Symptoms.—The symptoms of bladder tumor are not characteristic, and a diagnosis cannot be made positively without a searching urological examination. Hematuria, dysuria, pain, urinary obstructive symptoms, renal obstruction, anemia, cachexia, bone and nerve root pains, may all be noted in some.

Persistent pain in the bladder or in the back or along the great nerve trunks, associated with hematuria and a definite bladder tumor, usually means a metas-

tasis. Cachexia may or may not be present at this stage but invariably appears toward the end. Metastasis is not as common in malignant bladder epithelial tumors as in some other cancers, but is nevertheless frequent. The lungs, liver, kidneys, spleen, bones, and skin are favorite sites.

Dysuria, which varies from the mildest frequency to violent tenesmus, depends mostly on a secondary infection. It arises occasionally from an obstruction of the vesical end of the urethra by the tumor, and sometimes by blood-clots. Where the infection is pronounced, kidney involvement, perivesical abscess, or septicemia develop. Dysuria, though seldom occurring in a bladder tumor, is sometimes the very first symptom, *teste* thirty-nine out of 186 of our cases.



FIG. 728. — PEDUNCULATE PAPILLOMA IN FRONT OF RIGHT URETERAL ORIFICE.

Knee-chest posture. All-distended bladder. Admirable for treatment by coagulation of pedicle through cystoscope.

The most important symptom, and usually the first to draw attention to the malady, is hematuria, which was initial in 139 of our 186, and in 117 of Geraghty's 156 cases. This may remain the only symptom for years; it often becomes a matter of surprise how little constitutional disturbance results from a long persistent hematuria. Often, however, associated with the dysuria, due to clots, it leads to pronounced anemia. In many this anemia is the most serious complication and is the direct cause of death.

Diagnosis.—Palpation, cystoscopy, microscopic study of fragments of tumor taken by the cystoscope, and x-ray pictures are the principal means of diagnosis. The examination of the urine may show blood, micro- if not macroscopic, and sometimes bits of tissue.

Bimanual palpation—recto-abdominal in the male, vagino-abdominal in the female—is indispensable. Frequently tumors seeming small cystoscopically are found by this method to be large, hard, fixed, and inoperable. A general anesthetic is often of value here; usually gas and oxygen suffices. Small soft tumors, and those lying behind the symphysis, cannot be palpated.

The cystoscope gives accurate information as to surface of the tumor, as in Figure 728, and reveals its relation to the bladder as a whole, in addition to disclosing the exact site of the bleeding. Extensive areas of necrosis, edema of the bladder wall, lobulated and fissured surfaces, and incrustations, are manual signs of malignancy. On the other hand, delicate papillæ, regular in arrangement, and narrow pedicles, speak for benignancy. Occasionally the bladder looks normal from within or shows but a small area of ulceration, when the entire viscus is infiltrated with cancer under its mucosa. In the female, very accurate information as to size, location, color, and appearance of the intravesical tumor can be secured by the open air cystoscope, which also offers a ready method of getting tissue even when the bladder is full of blood. Unfor-

tunately, it is usually less satisfactory in the male, and for that reason every operator should familiarize himself thoroughly with the water cystoscope which needs more interpretation, but with a little experience is most satisfactory.

The taking of tissue for microscopical study is effected by a cystoscopic rongeur or with the open air cystoscope or by a duck bill forceps. Although there are theoretical objections to removing bits of the tumor, there have been



FIG. 729.—X-RAY OF BLADDER INJECTED WITH BISMUTH SUBNITRATE. SUSPENDED IN WATER.

Diagnosis: Papillomata; note detail in form and surface.

A.A.A.—Tumors.

Dark area between A.A.A. and C—bismuth.

C—Crescentic figure formed by air in bladder.

very few observed injuries to the patient from this maneuver, and the information secured is invaluable from the standpoints of both treatment and prognosis. First, as a rule, positive information is secured as to whether a tumor is a true neoplasm or some other condition; second, the tumor can be usually classified and graded. In the papillary tumors, it must be remembered that a little piece does not tell the whole story, as the tumor may vary in different areas. All the epithelial papillary tumors of the bladder show a remarkable tendency to

implantation, illustrated by the recurrences in the incision after operation. The idea has been advanced, doubtless with a real basis, that the multiple lesions encountered in many are not real implants but separate tumors from multiple foci. That this is possible is shown in skin, breast, ovaries, and the mucous membrane of the mouth, where multiple tumors, quite independent, are common.

The diagnostic use of the x-ray rests on the employment of some opaque solution in the bladder, such as sodium bromid, uranium nitrate, barium or bismuth salts. By this procedure, interesting and graphic records are securable as to location, size, and surface characteristics of the intravesical parts of the tumor, Figure 729. The bladder should first be filled with the solution, then emptied with a catheter and distended with air.

Treatment.—It is convenient to begin to consider the treatment by a brief presentation of the technical features of the several recognized methods now in use. These are, (1) surgery, (2) surgical endothermy, (3) radium, or (4) x-ray.

Surgery.—Surgery has a definite and well-recognized place in diagnosis. Sometimes, whether from the hemorrhage or a contracted bladder, it is impossible before an exploratory incision to determine accurately either the nature or extent of a tumor. It also at times affords an indispensable avenue for electrocoagulation and radium. The chief aim of surgery is, however, the wide and thorough removal of the tumor. Transurethral surgery, as practiced by Nitze, has no place except for tissue for diagnosis. Vaginal cystostomy is of great value where there is obstruction and as a palliative method. In women it is far better than suprapubic drainage.

The operative procedures are extraperitoneal cystostomy, with resections of parts of the bladder, transperitoneal cystostomy with resections of portions of the bladder (partial cystectomy), and total extirpation of the bladder, with transplantation of the ureters.

Suprapubic Extraperitoneal Cystostomy.—The general preparation of the patient and of the skin should be as in any abdominal laparotomy. If there is an infection of the bladder, a few days of preliminary irrigations will be of great value. The same general principles governing the selection of an anesthetic for any abdominal operation apply here. The bladder should be emptied with a catheter which is left in place. On the table the position giving the best exposure is a fairly high Trendelenburg. The incision, about an inch above the pubis and parallel to it, should be carried from the outer border of one rectus muscle to the outer border of its fellow, through skin, fat, and fascia. The muscles are then separated and retracted, exposing Retzius's space. The peritoneal reflection is found and pushed backward with care not to strip its investing fascia from the bladder, a most valuable layer in closing the opening. Before opening the bladder, locate the tumor by palpation if possible; in any case, the operator should try to avoid opening the area

occupied by the tumor. The bladder is more readily found and outlined if it is distended with air through the catheter. Once clearly recognized, it is caught with convenient clamps and opened transversely. Careful walling off of the incision and an efficient suction apparatus, are of great value in limiting contamination. With a bladder dry, the interior is easily explored with finger and eye. Simple, noninfiltrating, and pedunculated tumors are best excised with electrocautery. Infiltrating growths are best removed by a wide resection of the entire bladder wall after surrounding the disease with a zone of coagulation. If the ureter is involved, it must be located and reimplanted in the bladder after the removal of the disease. After resection, the bladder should be carefully closed in layers, using fine chromic catgut. In addition to the closure of the superior opening in the bladder, the investing fascia should be closed as a separate layer. Where all hemorrhage is controlled the closure may be completed, in which case a permanent catheter must be left in the urethra for several days. If hemorrhage is not controlled, a rubber tube drain may be placed in the bladder and brought out through the suprapubic incision after partial closure. Even when the bladder is closed, it is often best to drain down to Retzius's space. The abdominal wall is closed in the usual way, layer by layer.

Transperitoneal Cystostomy.—An incision directly into the peritoneal cavity, either transverse or midline, as recommended by F. D. Harrington (*Ann. Surg.*, 1893, 18) undoubtedly gives a much wider exposure and makes any surgical procedure easier. The disadvantages are the added risk of peritonitis and of shock. The risk of infection in women is minimized by free drainage into the vagina anterior to the uterus. Charles H. Mayo (*Ann. Surg.*, 1908, 48) was the first to put this operation on its feet, and E. S. Judd (*J. Am. M. Ass.*, 1912, 59) demonstrated that in capable hands it did not necessitate undue dangers, so it is now used by a number of operators. The bladder is opened intraperitoneally, taking special care in isolating it by packing; following the operation a thorough, careful closure is indispensable.

Total Extirpation.—Total extirpation, first done by Bardenheuer, in 1887, has never been widely employed because of its danger, its mutilating effect, and the fact that only about one in twenty of those so treated have stayed well. It is manifestly limited to disease too extensive for resection but still limited to the bladder. The care of the ureters is one of its greatest problems, the best plan probably being an immediate implantation into the bowel, a much safer procedure these past few years. Bardenheuer brought his cut ureters to the surface in the abdominal incision. The bladder should be removed without opening; the approach is always through the transperitoneal incision and drainage is of course indispensable.

Surgical Endothermy.—The reader is referred to Chapter XLVIII for the details of apparatus and general principles of desiccation, electrocoagulation, and amputation, methods greatly extended since the original reports of Doyen

and Beer in 1910 and now firmly established as a valuable way of treating a benign papilloma, as well as most noninfiltrating tumors. It may be used to excellent advantage transurethrally through the open cystoscope. In addition to its curative effect, it is often valuable in checking hemorrhage. Geraghty considered the monopolar or Oudin current as satisfactory as the bipolar or d'Arsonval. The current is carried from transformer to tumor by fine insulated copper wire passing through the cystoscope, Figure 730. In gynecological urology, the knee-chest posture, a hard rubber Kelly cystoscope, and a



FIG. 730.—METHOD OF USING DESICCATION OR COAGULATION THROUGH AIR-DISTENDED CYSTOSCOPE.

carefully insulated applicator, afford an excellent arrangement. It is sometimes possible to destroy a large pedunculate tumor at one sitting by attacking the pedicle. A convenient method is to treat every five days until the tumor has disappeared, occasioning but little discomfort. In addition to cocainizing the urethra, it is well to anesthetize the bladder with a 10 per cent novocain solution retained for twenty minutes before treatment. When used through the cystoscope, the bipolar current must be carefully watched so as to avoid sloughs. When treating through a suprapubic incision, the bipolar current may

be used to great advantage. Care must be taken to keep the large surface pad on the skin well wet and in close contact to avoid a skin burn.

Radium.—It is eminently advisable for one planning to use radium in the bladder to familiarize himself with the fundamental principles of radiation. Our chief reliance is upon the gamma-rays; the intensity varies inversely with the square of the distance; 6 millimeters of tissue form an efficient screen from the more irritating rays; overtreatment causes more discomfort and is more undesirable than undertreatment.

Gamma-rays are applied to bladder tumors, (1) from the outside through the skin; (2) from the interior of the bladder; (3) from the vagina; (4) from the tumor interior. The entire treatment can be given through one of these routes, or the several avenues can be combined in various proportions. The dosage can be applied either in a single continuous treatment or fractionated

and extended over several weeks. When fractional dosage is used, the total is somewhat larger than when the treatment is given at a single sitting. However the treatment is given, it should be planned as a definite unity. This calls for a preliminary determination as to size, character, and location of the growth.

1. Treatment of a bladder tumor by radium from the body surface is sufficiently carried out only with a considerable quantity available. It can be replaced to some extent by deep x-radiation. A convenient apparatus for this kind of treatment is shown in Figure 731 with the radium at a distance of 2 inches from the skin, and each beam so directed as to include the whole tumor. In this way it is easily possible to give the tumor 1.5 times the dosage received by any one area of skin, obtained by passing the rays through separate portals through the front and back of the body. The actual dosage for each portal is 5 gram hours, the total dosage under this plan

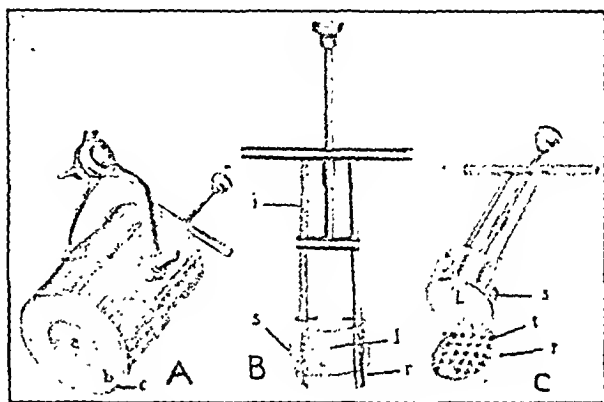


FIG. 731.—HEAVY LEAD CYLINDER AND RADIUM CARRIER EMPLOYED FOR EXTERNAL RADIATION.

Handle shown suspended to overhead trolley system permitting accurate adjustment. (*Am. J. Roentgenol. & Rad. Therap.*)

being 60 gram hours to all the skin surfaces, the equivalent of 7.5 gram hours at a distance of 2 inches to the tumor itself. Such a treatment is quite effectual for many tumors and should be repeated only after six or seven weeks. It is inadvisable to give a full treatment in a single protracted sitting; it is easier for the patient and more accurate to divide it into six to twelve doses on successive days.

2. Radium can also be applied from within the bladder, both conveniently and accurately, through the urethra, and under cystoscopic control. Where this is technically impossible on account of hemorrhage, contracted bladder, pain, or other cause, the suprapubic approach is available.

The method of application, the size of the dose, its distribution over the tumor, and fractionization, vary greatly with the location, size, and nature of the tumor being treated. The following suggestions will be of value. A single papilloma, not larger than 2 centimeters in diameter, is efficiently radiated with the applicator resting on the tumor, by a 1 gram half-hour treatment. In larger, single papillomata, it is usually better to implant. Several separate tumors can be treated in this way, but if a large part of the tumor is involved, it is more effective to use distance radiation, effected by filling the bladder with from 300 to 400 c.c. of sterile water, and placing the radium near the center of the organ and at least 2 centimeters from any bladder surface, and giving a total of 1.5 gram hours treatment. From a single application in this way

we have seen a bladder clear up completely. In malignant papilloma the dosage can be given similarly, but should be on the average 25 per cent greater.

In infiltrating tumors a decidedly heavier dosage is indicated. In one the size of a silver dollar, a full gram hour direct is advisable. In larger, flat tumors the principle described above for distance exposure can be employed, but the treatment must be carried to 3 gram hours. However, the bladder should be filled as completely as possible, and the radium kept far from the normal surfaces, with a distance of 1 centimeter from the tumor surface. A number of different settings of the applicator is necessary to equalize the distribution to all parts of the growth.

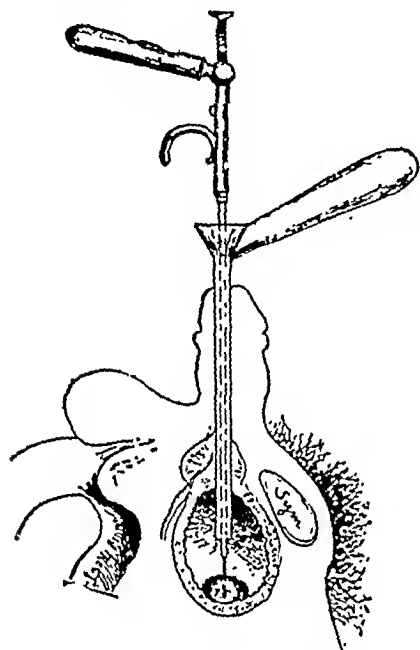


FIG. 732.—SCHEMATIC DRAWING, SHOWING USE OF APPLICATOR AND IMPLANTING INJECTOR THROUGH KELLY OPEN-AIR CYSTOSCOPE. (*Am. J. Roentgenol. & Rad. Therap.*)

When the bladder is contracted so that a distance of 2 centimeters from the normal wall is impossible, the treatment should not be extended beyond 1.5 gram hours, and recourse must be had to the other methods of application as adjuvants.

In the female, the method through a Kelly open air cystoscope is satisfactory, Figure 732. The radium in the form of emanation, or, as it is now called, radon, is conveyed in the end of a sound, Figure 733, which is passed through the cystoscope into the bladder and held in place by a specially trained assistant. A full gram hour treatment is given in six fractions of twenty minutes each when the applicator contains 500 millicuries. The duration of the application is proportionately longer or shorter with smaller or larger amounts of emanation. An alternate

method is by the use of the ingenious radium carrying cystoscope of Hugh Young, Figure 734; with the patient lying in the dorsal posture, legs comfortably resting in supports, and the cystoscope held by a stative, it is not inconvenient to treat for an hour at a time.

3. Treatment from the vagina is of limited value and should be reserved for tumors of the basal, trigonal, and urethral orifice regions. Overdosage must be avoided sedulously, and the applicator should never rest directly against the vaginal wall. A convenient distance is $\frac{3}{8}$ inch, at which not over 0.75 gram hour should be given to each 2 inches square of surface. The rectal side of the vagina should be protected by at least an inch of lead screening.

Intrarectal applications are of so little value that they ought never to be used. The amount of radiation a tumor gets by this route, without danger of injuring the bowel, is very small indeed.

Let it be said here that vaginal radiation alone is not to be recommended except as an adjunct combined with other methods.

4. Intratumoral radiation is effected by inserting radium salt, or radon, into the tumor by carrying needles introduced and left until the desired dosage is secured, or, much more conveniently, radon in a small capillary container of glass or metal, threaded into the point end of a hollow needle, is implanted into the substance of the tumor by introducing a needle under light and pushing out the capillary with an obturator.

Implantation can be done either through the urethra or through a cystostomy incision. In women, the Kelly cystoscope and the knee-chest posture make a transurethral in most cases quite as accurate as suprapubic implanta-

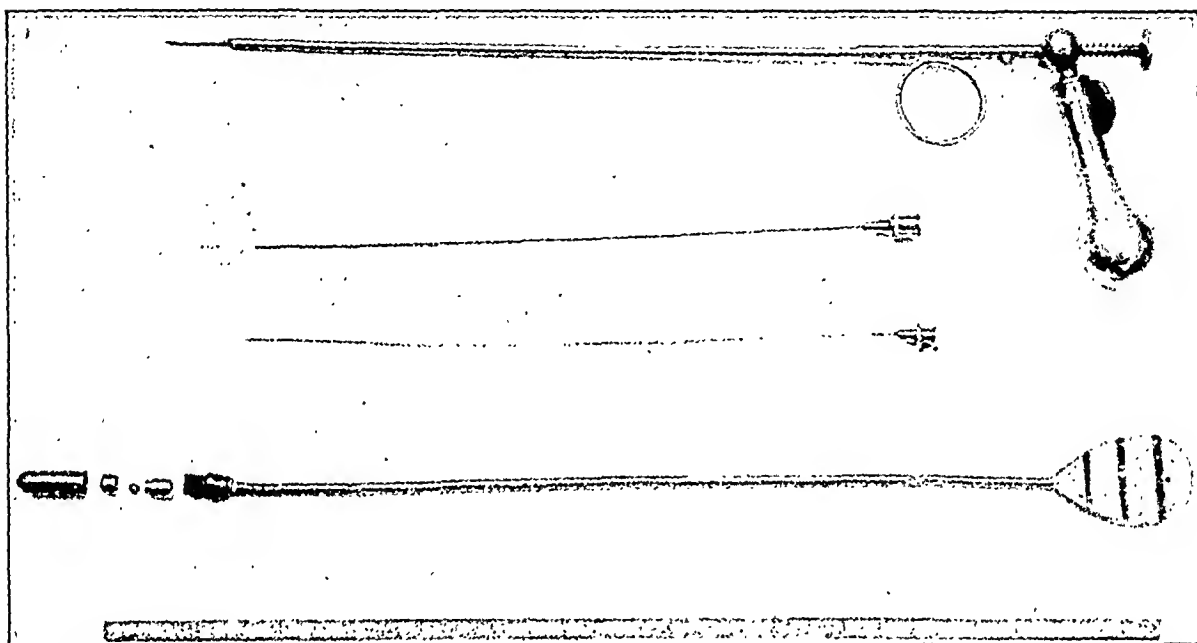


FIG. 733.—RADIUM CARRIER; PUNCH INJECTOR; LONG, STRAIGHT NEEDLES; CALIBRATED SOUND.
Used in radium implantations. (*Am. J. Roentgenol. & Rad. Therap.*)

tions. General anesthesia is rarely necessary. We formerly used the punch injector with a handle, shown in Figure 733, but we now prefer long, slender needles and a simple obturator, as a more delicate and accurate instrument. The depth of the implantation will depend on the thickness of the tumor. The aim should be to stay well within it, and not to approach normal tissues. In spherical tumors the deposit should be closely central; in wide, flat tumors each 2 centimeters square of surface should be implanted with a single point of 4 millicuries. The tumor ought to be less than 1 centimeter thick for this treatment. In a solid, spherical tumor, 1 inch in diameter, a single point of 10 millicuries is advisable; in larger tumors, the single point may be carried up to 20 or more millicuries. Our experience has been much more satisfactory with fewer and larger units of tissue, and larger unit volumes of radium, than with smaller and more numerous units. The principle of distance radiation, as well as the minimizing of beta radiation, combine here greatly to

reduce irritation, sloughing, and pain, associated with the implantation of each cubic centimeter with a point. This question is emphasized because of the prevailing notion that many points and small units are necessary for satisfactory results.

The same general principles apply when the implantation is through a suprapubic opening, an avenue of approach which is the rule rather than the exception in men, but only used for very large tumors in women. B. S. Barringer (*Am. J. Roentgenol.*, 1922, 9) describes an interesting apparatus for implantation with a water cystoscope; many similar appliances have been devised. These instruments make transurethral implantations possible in the

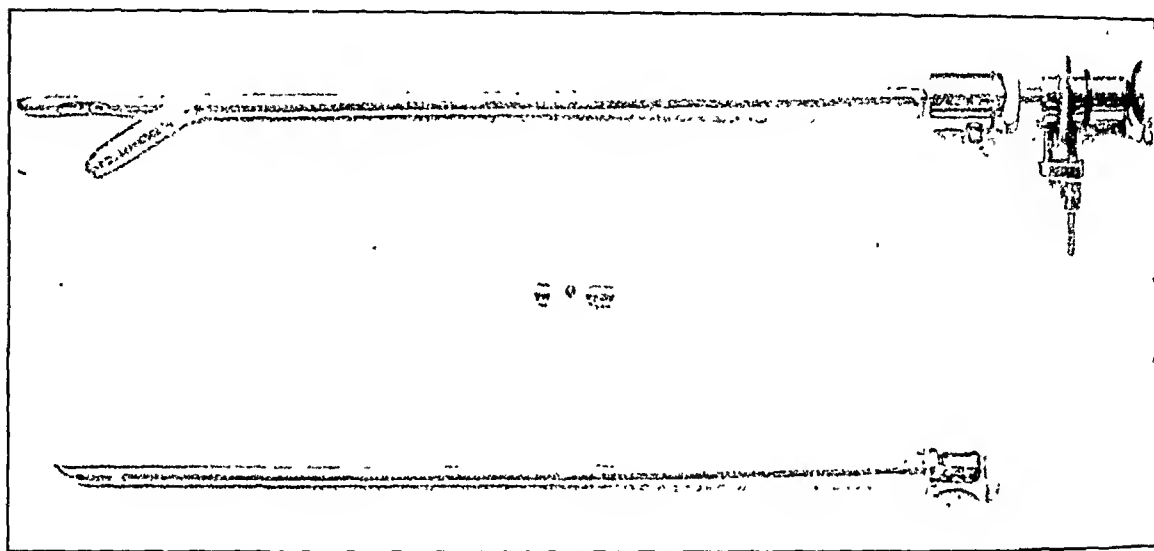


FIG. 734.—YOUNG RADIUM-CARRYING CYSTOSCOPE.

Light and optical system carried in obturator with radium tube in end of beak. (*Am. J. Roentgenol. & Rad. Therap.*)

male, but owing to the difficulties of vision, due to hemorrhage, the slowness of application, and the general manipulative obstacles associated with the water cystoscope, the method remains cumbersome and inaccurate as compared with our open air methods just described.

X-Ray.—The use of this agent has been greatly enhanced by the recent developments in x-ray apparatus and methods of dosage. C. A. Waters (*Am. J. Roentgenol. & Rad. Ther.*, 1924, 2), reporting experiences at the Brady Clinic of the Johns Hopkins Hospital, feels sure that there is here a very definite, valuable field in combination with other methods of treatment in attempting a cure, while alone it is a valuable palliative measure. We fully confirm his views by our own experiences. Though the impression made on the tumor seems less than that of a distance radiation with radium, the palliation in reducing hemorrhage, dysuria, and actual pain, has been fully as great. X-ray has the advantage of being more widely available in sufficient dosage and much more economical.

Our usual technique is to treat through four portals: one, midline, suprapubic; two, sacral; and one, perineal. The width of the portals, from 10 to 15 centimeters square, should take in the entire diseased area. A distance of 50 centimeters is maintained between the target of the tube and the skin of the patient. The screen is 1 millimeter of copper, 1 millimeter of aluminum, and 1 centimeter of spongy rubber. Much less nausea and general malaise follow the shorter exposures made possible by the higher voltages and greater milliamperages of the Coolidge water-cooled tubes. Using 240 volts, and 40 milliamperes, a full erythema dose is obtained in ten minutes instead of several hours as heretofore. With very little upset to the patient, and great accuracy of application, one portal can be used each day, until all four are covered, or the entire treatment can be given at a single sitting. Waters recommends fractional dosage, giving only about one-twentieth of the plan *per diem*. This is of value if lower voltages and milliamperages are used, requiring longer exposures, and thus entailing greater general discomforts; it has, however, the disadvantage of requiring much more time with possibly somewhat less accuracy in directing the beam. Full treatments should be given at intervals of from six to twelve weeks.

Results of Treatment.—It is safe to prophesy that many years will pass before the best form of treatment is clearly settled and applied in each case. This arises from the great differences in the character and extent of the disease, the kinds of treatment used, and the skill in applying the several procedures. It is extremely difficult to assemble uniform statistics. With the now well-determined value of distance radiation and x-ray treatment, few patients will probably be refused treatment, as only the moribund and the extensively metastatic cases need be excluded. Barringer urges that the very advanced cases are better left untreated. J. B. Deaver and Wm. H. MacKinney (*Ann. Surg.*, 1923, 78) estimate that one-third of all cases ought not to be treated. Seventy-five of the 527 reported by H. C. Bumpus (*J. Am. M. Ass.*, 1924, 83) are included in this advanced group, while we note twenty-six of our own 212 cases.

Papilloma.—Small, benign, pedunculate papillomata are almost universally treated by transurethral methods. Geraghty reported nineteen, all disappearing promptly by fulguration; and in six where fulguration was ineffectual, rapid disappearance followed the use of radium.

Though disappearance is rapid, recurrence is common in other areas after fulguration alone. There are but few reports based on observation over some years. In the large and very extensive papillomata, the results are by no means so good. H. C. Bumpus advocates in these a suprapubic cauterization removal. Kretschmer advises suprapubic electrocoagulation. The older suprapubic operative procedures had a high percentage of recurrences, but no one to-day would follow enthusiasts of a few years ago in urging the removal of the entire bladder in this group. Our own opinion is that a benign papilloma

should be treated by electrocoagulation and radium, or by radium alone. We have seen comparatively few cases, and most of them had already received treatment by fulguration. We have had eighteen cases between April 1, 1912 and April 1, 1925. Three were in women very anemic and ill, and with extensive involvement, and not one of the three was benefited; all have died. In the fifteen remaining, many quite extensive, nine have been cured for three years or more, the longest dating back thirteen years, treated by operation, radium, and fulguration. The rest received radium, or radium and endo-thermy. There is one 9½-year cure, and three seven-year cures in this group of nine. Of the six cases remaining, one is living and well after 2½ years, one died six months after treatment from pulmonary tuberculosis, and four died from malignant transformation and extension of the disease.

Barringer (*Ann. Surg.*, 1921, 74) limits transurethral treatment to pedunculate papillary and sessile growths of not more than 2 centimeters in diameter. Geraghty noted that out of thirty-six where the tumor disappeared through fulguration and radiation, in eight there were recurrences in less than a year.

Nearly all observers have reported better results in noninfiltrating malignant papillomata than in the infiltrating forms. The former are very much less common cases in our series. Out of our twenty-two cases, three were in very advanced stages and bad general condition at the time of treatment; two of these three cases were unimproved; one improved remarkably but finally died of recurrence. In the less extensive cases, nineteen in number, nine have been well for three years or more; two for ten years. In two of the nine cases well after three years, there was recurrence after four years, thus reducing the four-year cures to seven. Of the ten not included as cures, seven are still living for periods ranging from six to twenty-eight months; some are apparently free of the disease, while three have died. In two of the cures, radium and operation were combined; in the others radium alone was used.

Carcinoma.—J. Bentley Squier (*Surg., Gynec., & Obst.*, 1923, 37) in seventy-five cases treated by resection, reports twenty-eight alive after two to eight years. Barringer advocates suprapubic cystostomy and implantation of radium emanation in all of this group. Our experience with papillary carcinoma has been limited to eighty-eight cases, fifty-nine of which were massive and inoperable, and twenty-nine possibly operable. Of the fifty-nine inoperable, seven have been cured for over three years; one for twelve years; one of the seven apparently well at the end of three years, died from recurrence at the end of seven years. There was marked symptomatic benefit from the treatment in twenty; seven of these are still under observation and treatment, and thirteen are dead. In thirty-two cases there was no improvement. Geraghty stated that in infiltrating carcinoma he had had no improvement from radiation or fulguration, and that an operative resection is the proper

plan whenever the tumor is so situated as to make it possible; Lower who advises this method has had 7 per cent of cures beyond five years.

Among the twenty-nine earlier or possibly operative cases, six have been cured for three years or more. Of the twenty-three remaining, four were unimproved and died of the disease. Of the nineteen remaining, fifteen have died within three years; four are still alive under observation.

It is generally held that infiltrating carcinoma is amenable only in the very beginning, and then only by wide resection or radium implantations. Our experience with this class embraces fifty-eight cases; forty-nine very extensive and inoperable; nine less extensive possibly operable. Of the forty-nine extensive cases, four have been cured for three years or more; two of them for over six years, one for $3\frac{3}{4}$ years, and one for $4\frac{1}{2}$ years. In thirteen patients, there was symptomatic improvement, but all died within two years except one still under observation. In thirty-two there was no improvement. All of these were treated by radium alone. Of the nine operable cases, five have been cured for three years or more, the longest cure being nine and the shortest three years. All were treated by radium or by radium and endothermy alone. Of the four remaining, not classified as three-year cures, two are dead, one is living and with no symptoms after twelve months, and one died of an accident $2\frac{1}{3}$ years after treatment without any sign of recurrence.

Scholl observes that adenocarcinomata are somewhat amenable to radium and fulguration.

Sarcoma.—Treatment, principally operative, has been on the whole unsatisfactory, although one of Geraghty's two cases, a round-cell sarcoma, was well nine years after a suprapubic removal. Munwiz (*Ztschr. f. Urol.*, 1910, 4) found that in sixty-nine submitted to operation, thirty-eight died immediately and three were permanently cured. There is very little literature on the effects of radiation in this group. It was tried in both of our cases, a spindle-cell sarcoma and a leiomyosarcoma; in neither was there an observable change in the evolution of the growth. In both, however, the disease was far advanced and the patients in bad condition when we undertook to treat. In general it seems wise to urge that the treatment of sarcoma should proceed on the same general principles as in treating cancer of the bladder, although the results are likely to prove less satisfactory.

Myxoma.—The treatment recorded up to the present has been entirely operative. There have been a few cures, but the results have been very meager. Both of Scholl's cases died, and fourteen of Watson's sixteen, immediately or shortly after operation. It seems eminently desirable to test out the use of deep x-ray and more particularly deep distance radium radiation.

Angioma.—The results of operative and cauterization treatments have been excellent. Radiation apparently has not been employed, but judging by its effect on angiomata elsewhere, it gives promise of being by far the best treatment.

Myoma.—The operative risks, with a tendency to recurrence, are great. Of Watson's sixteen, but 23 per cent survived a year. Bleeding is usually pronounced. In regard to treatment, the statement under myxoma applies here.

Conclusions.—In small, nonmalignant papillomata, intravesical endothermy and radium applications give the best temporary and permanent results, and are the methods of choice. In large growths of this class, the same measures are often effective. To surface radium applications should be added implantation and external radiation. In some, suprapubic exposure, coagulation, and radiation give added security.

In small malignant papillomata, surface radiation and intravesical application of radium is the method of choice. Operative removal, coagulation through a suprapubic opening, or implantation of radium emanation have also a definite standing. In large tumors, transurethral implantations, suprapubic excisions and implantations, and resections and implantations must be considered. Resections should be limited to growths favorably situated. Implantations and intravesical radiation must be done in a careful manner; improperly used, they are harmful. In two autopsies, one on our patient, and the other on one from another clinic, the large cancers had completely disappeared but the patients died from severe sloughing due to excessive radiation. Postoperative prophylactic radiation, external and intravesical, are advantageous.

In cases of small papillary and small infiltrating carcinomata, unless situated in an easily operable area, the method of choice in women is by intravesical, transurethral radiation, and by implantations. Cauterization and coagulation are here of doubtful value. If on opening the bladder, resection is found easily possible, it should be done, and then followed by postoperative radiation; in medium-sized infiltrating tumors we advise the same practice. In large, manifestly inoperable tumors, the best plan in women seems to be transurethral surface applications and implantations, and external radiation. As stated, if a cure seems out of the question, it is wiser to limit the treatment to moderate, carefully considered transurethral radiation and thorough through and through treatments with radium, or, if not possible, by deep x-ray. These procedures often bring great relief lasting a long time.

To one doubting the value of such through and through radiation, we would point to two personal experiences. The first had a suprapubic resection for a carcinoma of the bladder, with a recurrence after a year, where, by external radiation alone, bleeding, dysuria, and pain completely disappeared leaving the patient apparently well for five years, when there was a recurrence and death. In another, a middle-aged man with a large malignant tumor on the base of the bladder, we secured no tissue, but from the external radiation alone the symptoms vanished and have never recurred in six years.

CHAPTER XLIII

PROTEIN THERAPY

GEORGE GELLHORN

A new method of attack on pelvic infections, particularly those of gonorrheal origin, is supplied by protein therapy. The body which has developed an imperfect immunity to a chronic infection can be so stimulated or excited by injection of nonspecific proteins that its immunity to the original infection becomes complete. The sudden shock caused by introducing unaltered proteins into the tissues, a condition never occurring in the regular metabolism of the body, calls for the rapid mobilization of defense forces; namely, an enormous increase in leukocytes and other less important adjuvants—antibodies and ferments. With the elimination of the proteins, there is a concomitant disappearance of the chronic infection, together with the evils caused by the toxic products of bacterial protein decomposition.

The work of the proteins may be likened to an army raised to expel a hostile foreign invader, which puts vast forces into the field and incidentally in its operations wipes out all other minor local disturbances. Or, to change the figure slightly, the army having expelled the invader is at hand to deal easily with the lingering lesser forces making for disintegration.

Aside from certain drugs, we have many other available beneficial cell stimuli—fresh air, sunlight, water in various forms of application, heat in moderate degrees, and other means of producing hyperemia, but none apparently as powerful as the parenteral administration of proteins which exerts its influence upon the totality of the cells of the body. In addition to this “omnicellular” effect, probably transmitted by way of the sympathetic nervous system, there is an even more marked impress made upon those cells which have been weakened or paralyzed by disease. This is, after all, not surprising since we have learned from physiologic researches that any cell previously involved, let us say, in an inflammatory process responds to stimuli of all kinds more readily than does a normal cell (W. F. Petersen, *Protein Therapy and Nonspecific Resistance*, 1922).

To those cells, then, which are engaged in warfare against bacteria, the new and powerful stimulation of a protein injection does what the whip does to the tired horse—causes a last, determined effort.

This final effort is represented by several important biological phenomena: The nucleus which was near dissolution, regains shape and size; fresh leukocytes and wandering cells appear, whose phagocytic quality is unimpaired;

the vasomotor and glandular activity is accentuated, there is an increased amount of blood sugar, fibrinogen, and thrombokinase; in short, the intracellular and intercellular metabolism is intensified, and with the acceleration of the chemical reactions within the cells, antibodies and ferments are poured out to weaken or neutralize the bacterial toxins; and, finally, there is a greater permeability of the vessel walls whereby inflammatory exudates are more readily absorbed. The whole process has aptly been described as "plasma activation."

All this we know from histological and biochemical studies; but, as George Gellhorn points out in various papers (*Am. J. Obst. & Gynec.*, 1924, 5:535; *New Orl. M. & S. J.*, 1926, 78:557), there are also outward and visible proofs of plasma activation in the so-called general reaction, consisting in most cases of chills and more or less high fever, or of a very slight rise of temperature accompanied by nausea, headache, perspiration, or a vague malaise.

After intravenous injections the general reaction is always more intense than after either intramuscular or subcutaneous injections. Pulse and respiration are but little affected. The fever subsides within twenty-four hours and almost always gives way to a very marked subjective improvement, which grows even more pronounced during the course of treatment. Appetite and sleep improve, and the depression of general malaise disappears. The rise in temperature is regularly accompanied by an increase of leukocytes; 20,000 to 25,000 are by no means an exceptional count, at least after the first one or two injections. This hyperleukocytosis fades away within two or three days to reappear, in milder forms, after each subsequent injection.

In addition to these constitutional manifestations there is also a focal reaction in the affected part which, while probably present in all cases, evidences itself only now and then by increased pain and swelling of the inflammatory tumor, both of these localized symptoms are, however, of very short duration.

Of course, plasma can only be activated if there is still a modicum of regenerative power left in the affected tissues. The duration of the infection, therefore, will have a bearing on the influence of protein stimulation, and practical experience has, in fact, demonstrated that favorable results are more likely to occur the earlier protein injections are administered.

The number of proteins used for clinical and experimental purposes, is large: Whole blood—both human and animal—immune and "empty" sera, egg albumin and serum albumin, casein, nucleoprotein, peptone, extracts of tissues and of endocrine glands, vaccines of all kinds. There are also several non-protein substances, such as turpentine and colloidal metals, which have been injected for the same purpose of plasma activation, and produce local destruction of tissue within the reach of the injected agent; the cell detritus is reabsorbed into the organism and now acts as a foreign protein.

In actual practice only a few of these numerous substances need be con-

sidered, milk being used most extensively since Robert Schmidt, of Prague, introduced it into medicine in 1916 (*Med. Klinik.*, 1916, 12:171).

Gellhorn followed the original procedure of Schmidt for several years, then modified it according to Graves, of Roanoke. The technique is now as follows: Ordinary household milk is rendered fat-free by centrifugation and so boiled for ten minutes in test-tubes in a water-bath, on two successive days, that the test-tubes do not touch the bottom of the vessel. By first sterilizing the centrifuge tubes and test-tubes, the probability of imperfect sterilization is averted. The milk is then drawn through a long needle into a sterile syringe. Pharmaceutical milk preparations, marketed in sterile ampules and under various trade names—aolan, etc.—may be used, but ordinary milk is generally preferred.

The site of injection is the outer and upper portion of the buttocks, and if the needle is thin and sharp and the injection is made slowly, the procedure is not painful though the bulk of the fluid injected may cause a momentary discomfort. The injection requires the usual antiseptic precautions. Local irritation denotes insufficient disinfection of the skin. Absorption is speedy, and I have never observed an abscess in the thousands of injections we have made.

The initial dose is 5 c.c.; the standard dose, which is reached with the second or third injection and then maintained throughout the course of treatment, is 10 c.c. In very feeble patients the first dose may be as low as 3 c.c., increased only cautiously.

The interval between injections is from three to five days, in indolent patients occasionally only two days. We are guided herein largely by the clinical aspect of the case and the leukocyte count. When the latter has receded sufficiently from its peak, new stimulation is in order. In mild cases, one or two injections will often suffice; in others more are required. The average number in Gellhorn's cases was about six. In puerperal infections, von Jaschke advises to continue the treatment until the fever has definitely disappeared. There must be a certain limit to protein injections lest they produce "protein cachexia," because excessive or protracted stimulation in itself must eventually lead to fatigue and exhaustion of the cells. Fortunately, this condition has thus far been observed only in animal experiments.

The general reaction sets in about six hours after injection. It used to be rather stormy in many instances, but since the employment of fat-free milk it has greatly abated, and chills and elevations of temperature are, as a rule, but slight, though hardly ever totally absent. In the course of treatment, the general reaction becomes progressively less pronounced. The intensity of the reaction seems to have no bearing on the final outcome; the increase of leukocytes is the deciding factor. Anaphylactic shock need not be feared; only three cases of this kind have been reported in the literature of the world. It is possible that in these cases the fluid was injected unintentionally into a vein,

and it is good practice to make sure that the needle has not punctured a vein by first drawing up the piston.

Focal reactions have been infrequent; when present, they disappeared after the next few injections.

The treatment requires no hospitalization unless the condition of the patient demands it.

The principal field for protein therapy in gynecology lies in the treatment of pelvic infections, particularly those of gonorrheal origin. In pyosalpinx, with or without exudate, the usual sequence of events is almost from the beginning a decided subjective improvement, resulting, after two or three injections, in complete subsidence of pain. It is this very relief from pain which makes it so difficult to keep our clinical patients, who are wage-earners and anxious to return to work, in the hospital long enough to obtain corresponding objective results. When the patient remains under sufficient treatment, the steady diminution and eventual disappearance of the adnexal tumors may well be observed in favorable cases. Exudates, even those of great dimensions, may vanish without a trace, though in some cases insignificant thickenings may remain. The earlier the treatment is begun, the more rapid and complete is success. At times even tumors of long standing respond with surprising rapidity. I have seen stone-hard exudates, which cemented the entire pelvis and obliterated all landmarks, melt away after half a dozen injections so that the thickened but now indolent tubes could be mapped out. In two instances, the tubes, originally the size of cucumbers, were found soft and patulous on laparotomy two and three months, respectively, after treatment. This, to be sure, may happen after the ordinary treatment, but certainly not as quickly nor as often as after protein therapy. In a fairly large percentage of cases, gonorrhea of the tubes and pelvic peritoneum can be cured by protein injections and in a still larger percentage rendered symptomless without resorting to operation.

This optimism is not universal; some have been disappointed in the results. The reason for such differences is not hard to find. Conservative treatment of any kind demands a certain degree of devotion, and in large clinics where hundreds of patients clamor for relief, it is rather difficult to bestow on a single patient the individual attention required. For it should be borne in mind that protein therapy by itself will not be sufficient to bring about a cure in most cases. Rather should it be combined with other tried methods of treatment. The protein injections have stirred up the affected cells to renewed activity and intensified the weakened defensive means of the body; it now remains to give further support to the tissues. We should facilitate depletion of the swollen and inflamed pelvic organs by means of glycerin tampons, properly applied; we must encourage an active hyperemia with all its healing properties by means of local heat, preferably through the medium of diathermy which seems to be the most promising method of heat penetration; rest in bed,

regulation of elimination through bowels, skin, and kidneys, nourishing food, fresh air, and sunshine are indispensable factors in a complete restitution. Even if no total disappearance of the tubal tumors can be accomplished, at least a condition can be achieved which, so far as well-being and ability to work is concerned, amounts to a cure. In one instance, after six months, there was a return of tubal swelling and exudate which again yielded to milk injections, heat, and rest; since the patient became a widow several years ago and is no longer exposed to reinfection, there has been no recurrence.

Cure cannot be claimed for every patient with ascending gonorrhea, for a number of refractory cases are observed, but Gellhorn feels strongly that protein therapy should be tried in every instance as it in no wise compromises later operation but rather renders it less difficult and less extensive.

Gonorrheal bartholinitis is, likewise, favorably influenced by milk injections. In several cases of this sort the swelling of the gland which had not yet assumed extensive proportions, subsided promptly after two or three injections. In one instance, the inflammation recurred in pregnancy, but was kept in bounds; the pus was apparently rendered sterile, for in spite of vaginal examinations and forceps extraction there was no infection in the puerperium. On the other hand, I had under my care a young woman with subacute gonorrhea and an abundance of gonococci in both the urethral and cervical discharges in whom milk injections could not forestall the appearance of a large bartholinian abscess which required incision and drainage.

Such failures merely indicate the limitations of the new treatment, a fact which should curb an injudicial overenthusiasm. Even at this early stage, it is apparent that not all parts of the genital tract are equally benefited by protein therapy. The ovaries, for instance, seem to be entirely unresponsive. Bladder and uterine body react somewhat more readily, while infection in Skene's ducts and the glands of the cervix, as a rule, remains uninfluenced. In only two frank gonorrheas have I seen the infection of the cervix clear up completely after milk injections; in all others, additional local treatment was needed. Adhesions are not affected; but exudates can be brought to absorption, or else a circumscribed suppuration is hastened so that they can be attacked surgically.

Numerous reports testify to the effect of milk injections in buboes; in most of the cases the injections practically aborted the lesions. Equally rapid results follow, as a rule, in cases of nonspecific boils about the outer genitals. Occasionally a second abscess occurs some days or weeks later and may require another injection.

Von Jaschke (*Tr. German Gynec. Soc.*, 1921, 16; 127) praises protein injections in genital and peritoneal tuberculosis. "Hyperpyretic and extremely sick patients became afebrile, sometimes after only three injections, and felt so much improved that they could hardly be kept in bed."

In a large pyometra following radium treatment for inoperable cancer of

the cervix, and in a lochiometra after cesarean section with excessive fever, results from milk injections were so prompt and convincing that coincidence might well be excluded.

Two large pelvic abscesses completely disappeared after five and eight milk injections, respectively; one was the result of an attempted abortion with slippery elm tents; the other followed a curettage perforation; in both, there was hyperpyrexia and hyperleukocytosis, severe peritoneal reaction, and a fluctuating tumor, extending almost to the umbilicus above and bulging down into the posterior fornix. Incision and drainage here gave precedence to the then new protein therapy with signal success. It by no means follows that the surgical evacuation of an abscess is now obsolete.

There have been some striking results in puerperal infections of milder degree where recovery promptly followed milk injections; severe infections have improved temporarily, with one complete cure.

The foregoing elucidates the extensive applicability of protein therapy in our field as a means of activating long familiar reactions identical with those engaged by the organism itself against disease. A trial with protein injections is, therefore, justifiable as an antecedent to any surgical treatment in bacterial diseases of the genital tract. Even apart from a cure, the patient's general condition is so noticeably benefited as to enhance the success of a subsequent operation.

The best measures, however, may be dangerous when applied injudiciously, so we must not be misled by the ease and simplicity of protein therapy into the error of neglecting due precautions and painstaking clinical observations. Cardiac decomposition, diabetes, and alcoholism are absolute contra-indications. A history of hypersensitiveness—serum-sickness, asthma, urticaria, angioneurotic edema—or epilepsy or other grave nervous instability demands, according to Petersen, the greatest caution. Above all, the actual status of the disease and the condition of the patient call for consideration. Only when the cells are not hopelessly damaged and the patient has not reached the state of complete fatigue, are milk injections justifiable, superimposing as they do an extra demand to which the exhausted organism is likely to succumb.

Yet, success is not always achieved, even where all conditions are favorable; a percentage of failures is to be expected. Protein therapy has its shortcomings in common with all other plans of treatment, but these do not nullify the value of a method proven in thousands of cases. We confidently expect the next decade, with additional studies of the phenomenon and with a more refined technique, will establish yet more securely a nonspecific therapy as the most rational medical procedure, exerting, as it does, its potent influences upon the very basis of bacterial disease—the affected cell.

CHAPTER XLIV

RADIUM

CURTIS F. BURNAM

PHYSICS

EFFECT ON TISSUES

APPARATUS

Sterilization

PROTECTION OF PERSONNEL

PRINCIPLES OF DOSAGE

CLINICAL APPLICATIONS

Urethra

Vagina

Cervix

Body of Uterus

Ovary

Vulva

Fibroid Tumors

Menorrhagia and Metrorrhagia

Dysmenorrhea

Sterilization

Tuberculosis of Pelvic Organs and Peritoneum

Chronic Pelvic Inflammatory Disease

Twenty years have come and gone since radium was first used in gynecology; the therapy is now world-wide and occupies an enviable position coördinate with surgical and medical measures.

To-day it holds first place in treating malignant urethral, vaginal, and cervical growths, as well as in menorrhagias and metrorrhagias; fully it is on a par with surgery in fibroid tumors, and, though secondary to surgery, it is of value in malignancy of the uterine body and the appendages; it is easy and safe in the induction of sterility for whatever reason indicated, and it has a well-defined place in pruritus and is even more effective in pelvic inflammatory disease, particularly of the tuberculous type.

The neophyte in radium therapy owes it to himself and to our long-suffering humanity before launching out as a specialist in this difficult and hitherto untrodden field, to spend some months at a clinic where it has long been in use and is thoroughly understood before he ventures to act on his own initiative: by doing this he will not only save much time but will also insure better

results in his work with less suffering and fewer accidents, sometimes amounting to loss of limb and even life. While many excellent books and hundreds of papers are scattered through our medical literature, it seems best, as the subject is still new to most, to touch upon certain general chemical and physical factors, and to speak briefly of the rays medically effective, considerations indispensable to accurate dosage in our practical treatments.

Physics.—Radium is a metal combining with various acids to produce salts, belonging to a group in a scale headed by uranium, with lead perhaps the last element; an entire series except the ultimate lead undergoing atomic decay. This instability varies enormously in several members of the group; it is lowest in uranium, very slow in radium, quite rapid in radon, and extremely rapid in the active deposit made up of elements termed radium A, B, and C. In this transformation from one element to another, three distinct kinds of rays are emitted, alpha, beta, and gamma. The alpha-rays are atoms of the element positively charged; the beta-rays are negatively charged ions; and the gamma-rays are extremely short vibrations similar to the rays of light, or x-ray. The alpha helium atoms representing about 92 per cent of the total energy given off by a radium preparation, have a velocity of about twenty thousand kilometers per second; one hundred and thirty-six million are given off from a single milligram of radium every second. The beta-rays, representing about 3.2 per cent of the total energy of the radium, have an average velocity of three thousand kilometers per second, approximately the speed of light. The gamma-rays, representing approximately 5 per cent of the total energy, have a speed of three hundred kilometers per second. It is likely that an x-ray tube submitted to two million volts would produce x-rays of the same wave-length as gamma-rays, but there is no x-ray tube of such capacity in existence. The length of the hard gamma-rays from radium C are measured in the thousandths of an Angström unit. The Angström unit itself is one ten-millionth of a millimeter.

Practically only the gamma-rays are used in gynecology. The alpha-rays of low penetrating power are stopped by a sheet of paper, or a centimeter or two of air. The beta-rays are absorbed by thin metal screens and by less than 1 centimeter of tissue, although detected at a distance of 1.5 meters in the air. The gamma-rays are extremely penetrating, both for metals and for living tissue.

The gamma-rays which are emitted from a radium preparation do not come from the radium itself, nor from the next element radon which is a gas, but from solid decomposition products, radium B and radium C; in order to utilize these rays it is necessary to enclose the radium in an air-tight container, otherwise the radon escapes, is diffused through the air, and radium B and C are lost. It is customary to keep the radium salt in a glass tube, enclosed in a metal cover; there is a gradual surplus accumulation of radon over the amount destroyed until in thirty days the products of growth and

decay are balanced. The largest amount of radon recoverable from a gram of radium at any one time is called a curie. It is customary to estimate radium in milligrams, centigrams, and grams; and radon in millicuries, centicuries, and curies. The amount of gamma-rays given off by a milligram of radium at full value is identical with that given off by a millicurie.

While radium undergoes decomposition so slowly that it reaches one-half value in two thousand years, radon reaches its half-value in only 3.8 days. Radon is secured by vacuum pumping from solutions containing radium, and can be placed in containers and utilized as radium. Some clinics, notably the French, prefer to use radium itself; American, among others, are partial to the radon.

Each type of apparatus has its advantages and disadvantages. The advantages of the radium salt container are its readiness for immediate use and the emission of a constant amount of radiation; its chief disadvantages are the danger of loss through misplacement, sterilization, or breakage, the large volume of the quantities necessary for treatments, and its lack of adaptability to all kinds of apparatuses. Where only a small amount of radium is available, however, the solid salt apparatuses are indubitably the most convenient and economical. Radon applicators on the other hand give off rapidly changing quantities of rays from the decay of the emanation, and involve as well the necessity of separating the emanation from the parent radium and then its accurate measurement, calling for a well-trained technical staff. Several companies, whose measurements are generally to be relied upon, sell radium and radon to physicians. The unassailable advantages of radon are that volume for volume the apparatus can be made a thousand times as strong, adjustable to any kind of instrument or appliance, sterilized by boiling, and handled without anxiety as to possible loss.

While the ordinary glass container filters out the alpha-rays, it permits the passage in large amount of beta-rays which are very caustic and only available when buried for about 8 millimeters from the source out into tissues. They are capable of producing painful and slow-healing burns in normal tissues. These qualities make no difference when beta-rays come into contact with the tumor tissue alone. Commercial houses selling radium furnish tables showing the filter capacity of the various metals taken from standard treatises dealing with the physics of radium. Four-tenths of a millimeter of platinum is sufficient for the complete elimination of the beta-rays. The same thickness of gold permits the passage of 1.5 per cent of the total beta-rays; it takes 0.6 millimeter of gold entirely to eliminate them. About 1 per cent of the beta-rays pass through 1 millimeter of lead, nor are they entirely removed by any thickness less than 2 millimeters. Two millimeters of brass or silver eliminate them. Gamma-rays from radium B are much longer than those from radium C, while the quantity of gamma-rays from radium C is about six times that

from radium B. To remove these softer gamma-rays emanating from radium B, much thicker screens must be used, conferring, however, no special advantage.

The intensity of radium radiation varies according to the law of inverse square and inversely as the square of the distance from the source of radiation. Unfortunately there is no conceivable way of concentrating radium radiation after the manner of light by lenses and mirrors; the distribution is from a point in the center of a sphere. In a vacuum it is possible to calculate at any distance the intensity of radiation at any point if the quantity is known at the unit of distance. The interference of air being so slight the same calculation applies. On the other hand, the intensity of radiation in tissue is very difficult to measure accurately, and our calculations are crude. The reason for this is because some of the primary gamma-rays are absorbed as they strike the tissue, and others are scattered in a manner similar to the reflection of light, so that at a depth of 10 centimeters the actual proportion of scattered rays measured at any one point may be very high. In addition to the primary scattered radiation there is a secondary much softer gamma radiation set up, known as Compton rays, or the K rays of tissue. Where any of these are absorbed we find a secondary beta radiation. There is no known quantitative way of measuring directly all these rays.

It is often asked if x-rays and the gamma-rays of radium have exactly the same effect. The physicist states that the effect of any radiation is directly in proportion to the amount of ray absorbed, whether long x-rays or short gamma-rays of radium, and the work of Krönig, Friedrich, and others approaching this problem from the biological experimental side, would seem to confirm this. However, on the other hand, it is a common clinical observation that there are marked differences in the biological effect, dependent on the wave length. It is our own opinion that the difference between the radiosensitivity of normal and tumor cells is much more evidenced with gamma-rays. There is no satisfactory method of determining the relative effects by actual measurement in the tissues.

The quantity of radium in an unknown amount is not determined by weighing, but by comparing its capacity to ionize air with the capacity of a standardized amount of radium—the well-known electroscopic method. This same property of ionizing air has also made it possible more accurately to measure the quality and quantity of x-rays.

The absolute unit of quantity for x-rays, called Roentgen or R, is the amount obtained in 1 c.c. of air by the application of one electrostatic unit as measured by a saturation current at sea level under normal atmospheric pressure and temperature conditions. It is necessary in calibrating that all the secondary electrons produced in the air of the measuring chamber be used, and that no secondary radiation should come from the walls of the chamber. As a matter of fact, even with radiation of a uniform intensity as measured by voltage, filters, and distance, it is hard to secure agreement between different



A.



B.

PLATE XII.—A. CANCER OF CERVIX BEFORE RADIATION. BILATERAL LACERATION; CYSTIC DEGENERATION OF ANTERIOR LIP; CANCER OF POSTERIOR LIP.
 B. ONE WEEK AFTER RADIATION. INTENSE HYPEREMIA OF TISSUES. (LILIAN K. P. FAIRBANK, *Surg., Gynec., & Obst.*)

observers, and where there is a great difference in the wave-lengths no uniform figure is applicable. Otto Glaser estimates that it takes on the average about fourteen hundred R units to produce a mild erythema of the skin, that 20 per cent higher causes a marked reaction, and that 40 per cent higher causes a burn. However, it is now recognized that even in a normal skin there are great individual variations, not only in the different parts of the body in each person, but also in the same part in different persons. Between the most sensitive and the most resistant this variation may be as high as 40 per cent. Even greater differences are found between tumors of the same histological type in different individuals, and indeed, in the same tumor in the same person at different times. It is still much safer in reporting x-ray dosage to state the distance of the target from the skin, the filters used, the ionization effect as read by the electrometer on the skin, the size of the field employed, the size and volume of the tumor or part radiated, as well as its distance from the surface, and the character of the tissue traversed by the rays.

In honor of Dominici, who did so much to clear up the principles of radium therapy, and probably a martyr to his work, it has been suggested that the name of the gamma-ray unit be called "One Dominici," defined as the energy of the gamma-rays of 1 decigram of radium at a distance of 2 centimeters, in one hour, in terms of tissue absorption.

In reporting radium results, it is necessary to state the amount of radium or of radon, the filter used to secure pure gamma-rays, the duration of the application in minutes or hours, the shape and size of the volume radiated, and the distance from the source of radiation. With these factors, it is possible to estimate dosage. It seems to us that the scattered and secondary radiation fully makes up for the amount absorbed by the tissues, making it possible to estimate directly from the above factors. In radiating from a single point, one must calculate a dose heavy enough to put a lethal amount into that part of the tumor which lies farthest from the source; any less amount is ineffectual. It is obvious that such a single point radiation is disadvantageous where irregular volumes are treated, as often in gynecological malignancies, and this brings up the question of distribution of the radiation. Absolutely homogeneous radiation is impossible, but by utilizing many portals or avenues of approach, it is possible to treat all parts effectively without greatly overtreating the surrounding parts. The lethal dose for all types of epithelioma from a single point is a distance of 1 centimeter and $\frac{1}{4}$ gram hour, equal to 250 millicurie hours, or 1 gram fifteen minutes. Some neoplasms, as will be stated, are much more radiosensitive.

It is a good practical method to construct a diagram or a model representing the exact size of the lesion, on this to work out the best distribution of radium applicators, and following this to assemble the applicators and treat the patient. Such a recommendation refers to the highly refractory malignant

growths, and not to the simpler bleeding cases, fibroids, and their congeners, where dosage alone is the important factor.

With radon applicators, one cannot use quite the same factors in determining dosage, as the efficient agent; the radon is constantly undergoing decay and is less at the end of treatment than at the beginning. Where the treatment is given with an intense applicator and lasts only for a few minutes or for an hour, the decay factor can be disregarded. For all applications for a period shorter than seventy-two hours the average dosage is estimated by adding the initial to the final amount, dividing by two, and considering this figure as the fixed amount used throughout application. Where a single millicurie of emanation (radon) is buried in tissue, the whole dosage is estimated equivalent to 132 milligram hours. It is convenient for those who use radon to have tables at hand showing this rate of decay. In France, it is the common practice to take the number of microcuries destroyed per hour as a measure of amount or intensity. One milligram of radium in stable equilibrium loses by decay 7.55 microcuries per hour. It is possible to estimate the total number of microcuries destroyed in any radon applicator by using a formula in which the quantity at the beginning of radiation, less the quantity at the end of radiation is divided by the time of application and multiplied by the constant of decay—or hourly about 7.5 microcuries.

Effect of Radium on Tissues.—The various cells of the body, as stated, show differences in toleration to gamma and x-radiation. The well-known susceptibility of normal and pathological lymphoid tissues of the normal and tumor tissues of the ovary and testicle, and of the hemopoietic system need only be recalled here. Since the first decade of this century, experimental and clinical observations have shown that the rapidly growing are more sensitive than slow growing tissues, and that undifferentiated or embryonic cell types are more sensitive than well-differentiated cell types. The marked microscopic changes in the chromatin suggested further that the nucleus was the vulnerable part of the cells which are also most vulnerable while in mitotic division. Much importance has been attached to the microscopic appearances of tumors, both carcinomata and sarcomata, graded as to malignancy by Broders of the Mayo Clinic, whose criteria are based on the amount of chromatin, the presence or absence of differentiation as shown by an approach to the normal, and by the amount of mitosis. There is no question but that the prognosis, so far as metastases and the extension of the disease are concerned, can be made on such a basis. It is also fortunately true that the highly malignant tumors composed almost exclusively of undifferentiated cells, are far more radiosensible than those of low malignancy. It is not, however, clear that it is safe to lower the dosage beyond that required to destroy the differentiated cells which are always present. It seems to us that the question of treating at a time calculated to catch the cell at mitotic division is much more debatable; Regaud attributes the superior results in treating epithelioma with radium as con-

trasted with x-ray to the character of the radiation, and insists on a series of treatments extending over fourteen days. This brings up two questions: Are cells more vulnerable at one time than another? And is the amount of radium, multiplied by the time of application, applicable to all quantities and times? It is obvious that the intensity can be reduced and the time prolonged to such an extent as to have no effect on living tissue, because the reparation processes make up for any destruction. It is also true that as the intensity is diminished the time must be more than proportionately increased. However, within a range of from one to fifty this is not a vital factor, and one of the surprises of our work has been to see how closely the biological effects are in accord. Contrary to the view stated above, our experiences show that the difference between a normal cell and a tumor cell from the same source is clearly greater with an intense dosage than with a prolonged mild dosage. This has been observed both in gamma and in x-radiation. In the latter, with an equal effect on the ovaries and with equal dosage as measured by ionization, there is not anything like the same general disturbance, nausea, vomiting, weakness, and general malaise observed when 50 milliamperes are used instead of 4.

A curious phenomenon in radiation is the latent period. Whatever changes take place after a radiation must be initiated at once; nevertheless, it is sometimes days or even weeks before the change is discoverable by any gross or microscopic examination. Depending on the intensity of the treatment, a tumor or a group of cells can be immediately destroyed as by a caustic; or, there may be no caustic effect, but the reproductive power so destroyed that when the cells grow old they die and no new ones replace them; or in the still milder radiations, the only effect may be to slow up reproduction temporarily. In the latter case the tumor shrinks notably from the more rapid death than birth of cells, only to recover and grow again after a certain period.

Unfortunately we know little about the life history of cells, of different types, whether normal or pathological. The wholesale destruction of the cells of a lymphosarcoma by radiation, as well as the mushroom growth of these tumors, indicates that life of the individual cell is of very short duration, while the slow reduction extending over months in a fibroid tumor affected by a single radiation certifies a life of months for the fibroid cell.

It is apparent that the changes in an epithelioma of the cervix from intense radium radiation are rapid, the effect of the radiation being twofold: first the destruction of the cancerous epithelium, and, second, perhaps a stimulation of the fibrous stroma.

As the epithelium dies, it is gradually replaced by a scar. The effects in the ovary are greatest in the quiescent ripening follicles. Radiations as usually given exert no influence on the connective-tissue stroma. By grading the dosage it is possible to produce a selective action in the ovaries and to destroy the ripening follicles, causing a temporary sterility, or, to increase the dosage and

destroy the primordial follicles, causing permanent sterility. The persistence of menstruation for one or two periods after radiation, is dependent on the greater resistance of the corpora lutea; if the dosage is not too great one or two periods always follow.

It is a familiar fact that frequently repeated insufficient dosage seems to confer an immunity on the cancer cells, making it increasingly difficult to cure by radiation. This "vaccination" is a puzzling phenomenon when we

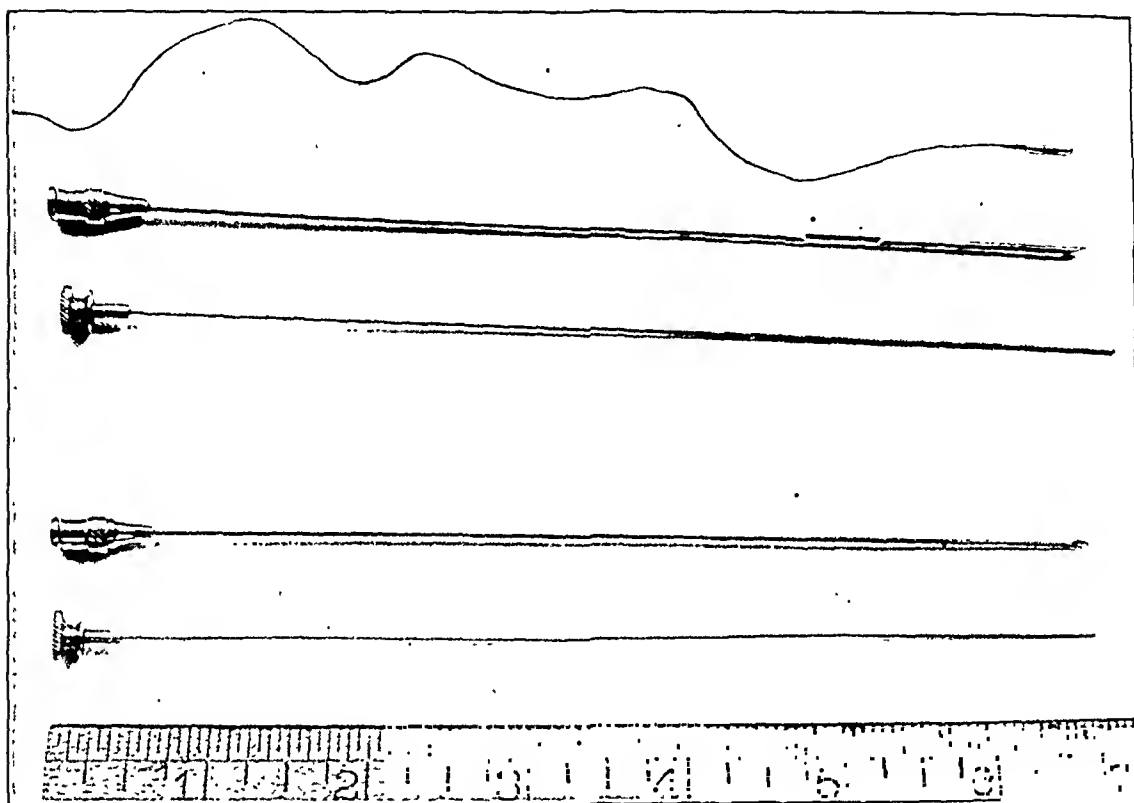


FIG. 735.—TWO TYPES OF NEEDLES FOR IMPLANTATION.

Lower, ordinary straight needle with plain glass tube or gold-covered glass tube seen just above its point ready to fit in end, to be discharged and implanted in tissue by obturator. Above, gold tube with strong thread attached to be threaded through slot on side of needle; obturator pushed down against needle thrusts it into tissue. First, obturator is withdrawn, second, the needle, and finally, the tube, when treatment is finished.

recall that normal tissues, repeatedly radiated, become more and more sensitive. Following a burn a fraction of an ordinary dose will excite a violent reaction. The explanation probably lies in the fact that normal fibrous tissue, surrounding the cancer, is rendered less capable of exerting its normal restraint over the cancer cells. It is rarely possible to go on treating epithelioma with the same dosage as one untreated, without resultant severe sloughs and necroses. The connective tissue in such conditions loses its normal fibrous structure and shows hyalinization and thickening and occlusion of the blood-vessel walls and lumen.

Apparatus.—For solid radium salts, and a total amount limited to 100 milligrams, the most convenient applicators are platinum needles, about 2 cen-

timeters long, with an inside 0.5 millimeter bore, and an eye in the end through which a thread can be drawn. The insoluble sulphate of radium is the best salt; about 10 milligrams can be placed in such a needle whose walls should be 0.5 millimeter in thickness. In addition to the needles there should be gold or brass tubes of platinum, capable of holding five needles, making a tube 50 milligrams strong.

Where radon is used, similar tubes may be employed, our own custom being to make them with a wall thickness of 2 millimeters of brass, a bore of 2 millimeters, and a length of 6 millimeters. Such a tube will take a small glass

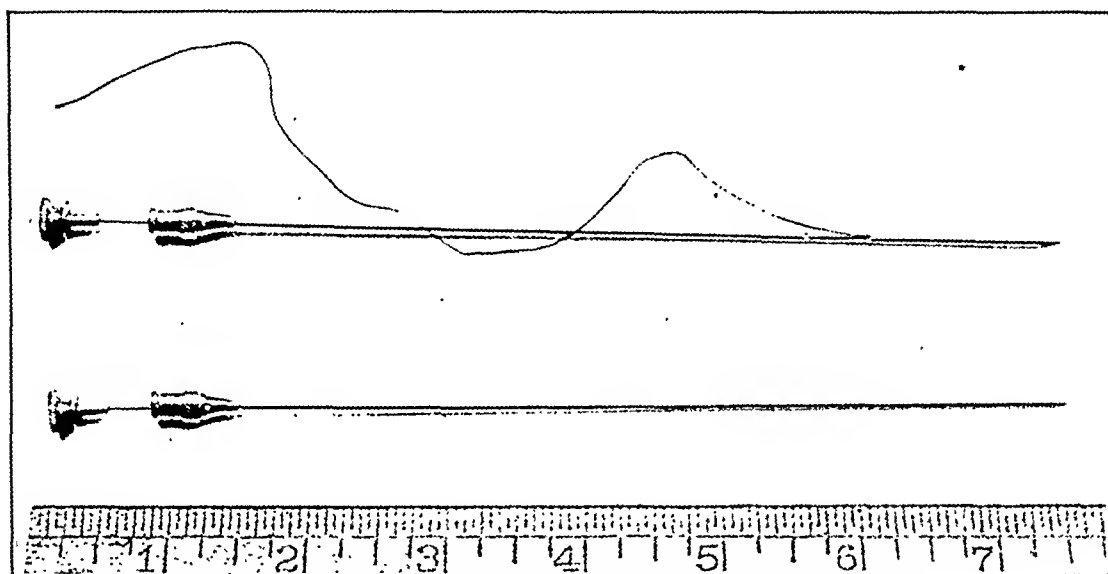


FIG. 736.—TWO FORMS OF NEEDLE THREADED AND READY FOR USE.

bulb containing any desired amount of radon up to a curie. For implantation, the emanation is put in an exceedingly thin glass tube about 2.5 millimeters in length, and this is inclosed in a gold tube with an outside diameter of 1.1 millimeter, an inside diameter of 0.5 millimeter, and a length of 4 millimeters. Such a tube will accommodate any amount from a fraction of a millicurie up to 50. Where the plan is to remove the little tube after a time, a fine stout silk thread is fixed in one end. The introduction of such tubes into the tissues, is effected by using hollow needles and obturators; when a string is attached, it is brought out through an opening in the lateral wall of the needle.

These various tubes and needles can also be distributed on flat applicators so as to secure a fairly uniform dosage to underlying surfaces. In treating the cervix from the vaginal cavity, and in treating vaginal, vulvar, and urethral areas, such flat applicators are indispensable. One must not forget that when gamma-rays traverse a dense metal screen, they set up secondary soft irritating radiations. This difficulty is met by separating the tubes and needles from the surface by some material of low specific gravity, such as rubber, felt, gauze, or wax.

Cross-fire radiation from the surface of the body calls for a large amount of radium. To facilitate this we have devised a heavy lead cylinder carried on an overhead trolley system, and furnished with suitable joints for directing the beam. It is easy with such an appliance, acting through the surface of the body by multiple portals, to deliver a destructive dose to a carcinoma, both into the parametria and on to the cervix. This procedure is exactly comparable to our deep x-ray treatments, and the dosage can be estimated by charts taking into account the loss in intensity due to distance, to absorption, to scattering, etc. Figure 738 shows various types of applicators used. To

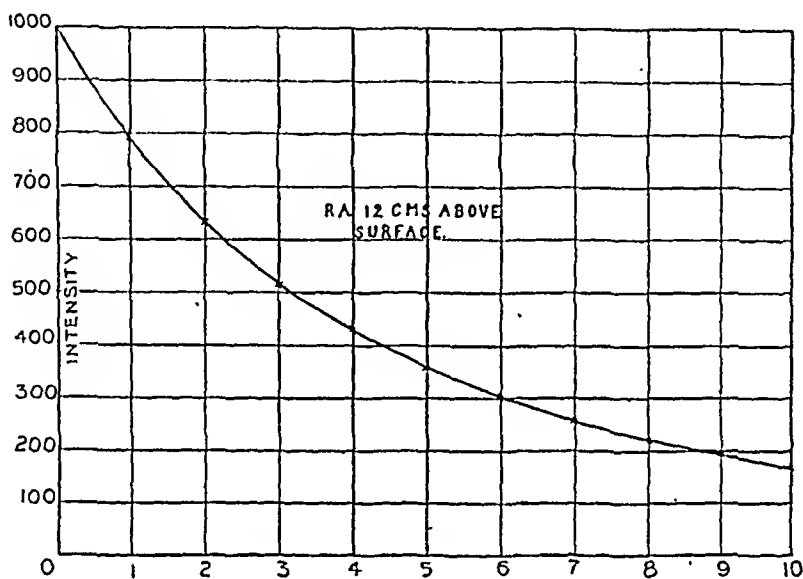


FIG. 737.—DECREASE IN INTENSITY OF RADIATION DUE TO ABSORPTION IN TISSUE AND TO SPHERICAL DISPERSION WHEN APPLICATOR IS 12 CENTIMETERS FROM SURFACE.

these add the instruments used in handling the tubes, and convenient lead screens for protecting the rectum and other normal parts which it is undesirable to submit to intense radiation.

Sterilization.—The easiest and best way to sterilize radon tubes is by boiling. With both radon and radium applicators, it is always well to have at hand a small piece of willemite to test whether they are active or not, all the more necessary when the radon tubes are boiled. Tubes containing radium salts must not be boiled and are best sterilized in carbolic and alcohol solutions, or in formalin.

Protection of Personnel.—When using large quantities of emanation, or radium, it is very important to protect the personnel against the injurious effects of repeated contacts with the rays. This is done by working behind thick lead screens, by surrounding the radium with lead or other heavy metal, by frequent change of technicians and nurses, and by planning that the physician treating has as short exposures as possible. These measures are directed against the general dangers from radiation. Frequent blood-counts, general physical

examinations, and periods of complete absence from the work are also most important.

There is no risk of this sort to the worker with 100 milligrams, even with almost daily continuous contact for years, but it is very important that he should protect his fingers by handling radium applicators with forceps—the longer the better. Great care must be used in handling radium tubes not to bend or dent them. A certain amount of radium emanation will seep through a thin-walled platinum tube if there is no glass container inside of it, and there is a notable tendency for the inside glass tubes to break.

Principles of Dosage.—Whether located in bladder, urethra, vagina, cervix, or parametria, the same general principles of dosage must be observed to secure uniform and favorable results.

Assuming that the apparatuses emit only gamma-rays, and are made so as to take care of the soft secondary radiations from the metal container, the effort should always be made at the first application, or in the first series of daily applications, reckoned as a single dose, to give a lethal blow to the entire diseased area, as a very insufficient dosage undoubtedly stimulates growth. As stated, the sensibility of the

tumors varies with the microscopic structure, in the sense that the more undifferentiated and malignant appearing growths are destroyed by a smaller dose than the seemingly less malignant. It must also be remembered that there is great variation in the structure of every tumor in its several parts, and for this reason as strong dosage as is consistent with the conservation of the normal adjacent structures should always be given regardless of the microscopic appearance.

Preliminary to treatment a biopsy must determine the extent of the growth so far as possible by all available methods of inspection and palpation. Its

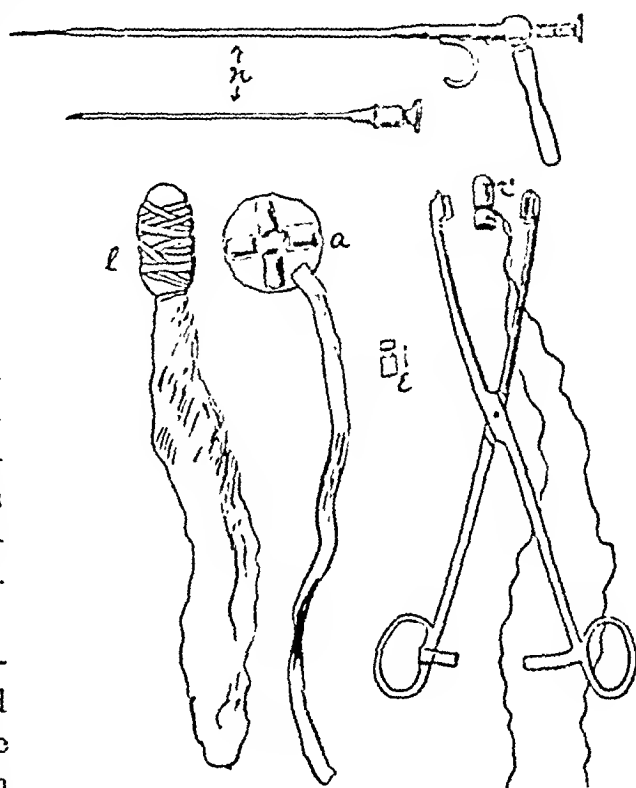


FIG. 738.—RADIUM APPARATUS EMPLOYED IN TREATING CERVICAL CANCER.

Above, two forms of needles (*n*) for implanting small tubes in tissue: to left, thick lead screen (*l*) bound by gauze and adhesive; immediately next to it, round piece (*a*) of strong material with tape attached and pockets for radium tubes. Tube and minute point for implanting emanation (*c*) to right of applicator. On extreme right, tube in small rubber cot (*c*) with forceps for introduction into cervix.

actual volume and contour should be plotted and an effort made so to dispose the radium-carrying apparatuses that every part of the tumor receives its minimum lethal dose.

At a distance of 1 centimeter this lethal dose is represented by a treatment of 1 gram fifteen minutes or as more commonly expressed, by 250 millicurie hours. Taking this as our unit, the radium must be so distributed that every part of the tumor receives at least this amount. Where thin cancers, but widespread growths occur, as on the vaginal walls, it is more convenient to act at a distance of from 1 to 0.5 centimeters from the surface, and to apply this dosage to each square centimeter. It must be kept in mind that when centimeter squares cannot all be treated individually, the cross-firing takes care of many of them. When the applicator is buried in the tissue, if strong tubes are used the treatment is terminated in a few hours, and this same factor of cross-firing must be taken into account. If, however, weak tubes are buried, and left in place, it is better to calculate on a 1 gram-twenty-minute dosage. In estimating the tissue as divided into cubes, the angles receive the smallest treatment. By using the right angle triangle method, and remembering the law of the inverse square, it is possible to calculate quite accurately. In spherical tumors, a single very strong source of radiation may be placed at the center of the mass. It is well to consider the units of dosage as per cubic centimeter, per cubic centimeter and a half, and per 2 cubic centimeters.

While we believe as stated that the preliminary treatment should always be a full dose, wherever it is fractionated, as say in intervals of every day for ten days, great care should be taken to duplicate exactly the disposition of apparatus, adding 25 to 50 per cent to the dosage.

At least two months should elapse before an area is re-treated, when it is then usually necessary to diminish the dosage. Disease found later in an area not as yet treated should be radiated as heavily as a primary treatment.

Clinical Applications.—*Urethra.*—In caruncles which show a tendency to recur after surgical or coagulation removals, radium is often effective. A convenient applicator is a small emanation tube filtered to exclude beta-rays and applied directly to the growth, giving 1 gram for six minutes. When the caruncle is entirely external, $\frac{1}{8}$ inch of felt or rubber may be interposed and a dosage of 1 gram twelve minutes given. In all treatments it is important to protect the adjacent normal vulvar parts. Either of these procedures will cause a slight whitish painless burn which heals in a few weeks. The percentage of recurrences after radiation is very small, even in these patients who have had a number of operations.

Malignant urethral tumors are rare; of about twelve personal observations, two were sarcoma, two adenocarcinoma, and most of the others principally composed of transitional cells. Many grew rapidly, spreading from the outer extremity along the urethral wall, and, owing to the pain and obstructed urination, they have usually been seen before metastasizing. They are rarely curable

by surgery. One of the sarcomata, where there was a direct application of radium, an overtreatment in that it caused a painful burn persisting for months, has been well for a number of years. Two of the transitional tumors healed and remained well without impairment of the bladder function. One of the two adenocarcinomata which was most malignant and which has now been well for two years, and is of sufficient interest to report was E. R., aged eighty, who entered the hospital in March, 1924, with high blood-pressure and a chronic cystitis for years. A little caruncle inside the urethral orifice proved to be an adenocarcinoma. The distal end of urethra and the base of growth had been destroyed by cauterization, and her coming was for prophylactic treatment; as the only obvious lesion was a small cautery burn, we waited. In three weeks she returned suffering dreadfully from obstruction, with a large hard infiltrating growth occupying entire urethra and extending out to the left pubic ramus where it was fixed. Microscopically, it belonged to Grade IV malignancy. The treatment consisted in burying two bare radon tubes of 10 millieuries each. In less than a week the obstruction had disappeared without loss of function, and there has been no recurrence.

In very small tumors surface radiation at a distance should be the method of choice. In larger and infiltrating growths a burying technique is preferable. While the bare tube technique furnishes excellent results, there is much less irritation and better healing after gold implantation, especially where the tubes attached to a thread are withdrawn.

If the vesical sphincter is involved, it is sometimes impossible to preserve it. The treatment of metastatic glands in the groin is by surgery or electro-coagulation, if they are free and movable, and by combined implantation and external radiation when they are fixed.

Vagina.—Excepting venereal warts, most primary vaginal new growths are malignant, and nearly all are epitheliomata. Sarcomata and adenocarcinomata are extremely rare. The usual microscopic picture is one of high malignancy. Metastases are common, and there is often a penetration through the paravaginal tissues out to the pelvic wall; a common type however spreads over the vagina so as to cover it with a thick layer transforming it into a narrow rigid tube. Secondary extension from cervical carcinomata to the vaginal wall is common, and sometimes extensive. After hysterectomy, and after radiation for cervical cancer, we have seen many patients with metastases low down almost at the introitus. Such recurrences may appear years after the disappearance of the primary disease. In the vaginal cancer it is important to determine the status of bladder and rectum, and a preliminary cystoscopy and proctoscopy are indispensable. Where there is no direct extension and even occasionally where there is, it is possible to cure without fistula. Contrary to the usual statements in the literature, our experience shows that these tumors are often curable.

The importance of early treatment applies here as in all cancer, the methods

being along the lines indicated. The vaginal walls are treated by the flat apparatus and by it alone, unless the paravaginal tissues are involved, when the burying technique is best. If after eight or ten weeks there is still trouble, a second treatment should be given. Most of our successes have followed the first treatment.

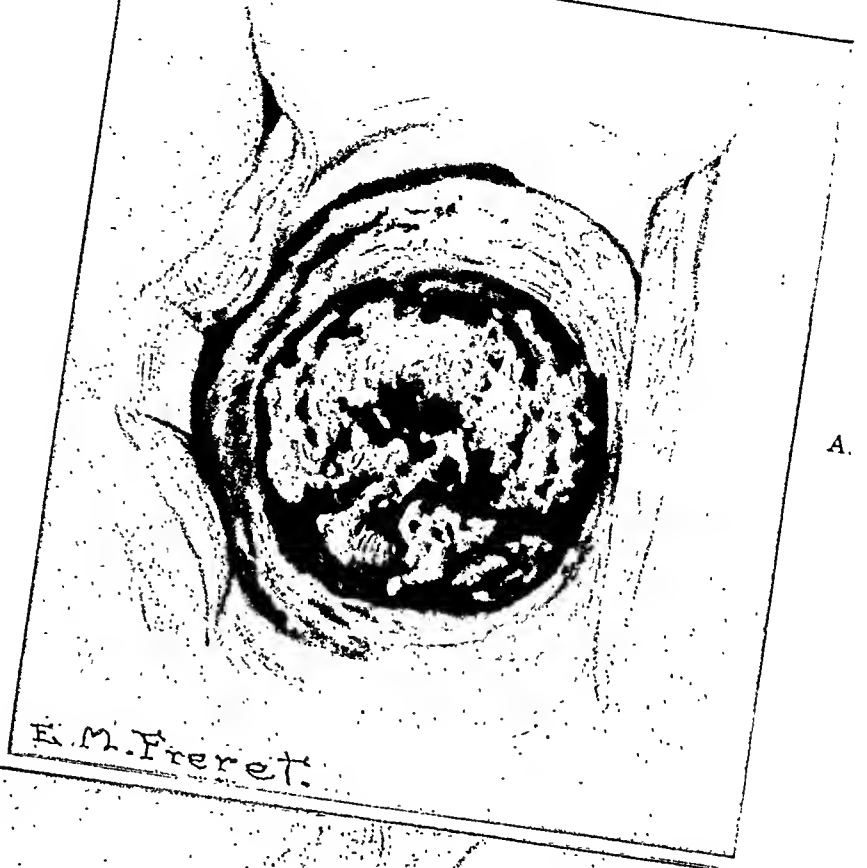
When the disease either by reason of the metastases, or its enormous extension, is incurable, the indication is greatly to reduce the dosage, aiming for palliation. In some of the more sensitive tumors, extraordinary results have been secured by half the assumed standard dosage.

Cervix.—Arthur H. Curtis (*Surg., Gynec., & Obst.*, 1923, 37 and 48) has reported excellent results with radium treatment in chronic cervical leukorrheas refractory to other methods. We have had little experience here as results have been so good from other forms of treatment.

Cervical cancers are of three general pathological types, squamous cell and transitional cell epithelioma, and adenocarcinoma, all in the large majority highly malignant histologically and clinically, Grades III and IV predominating. The rare spindle-cell sarcomata are on the average more resistant than carcinomata. Histologically, the grading is much more uncertain, as benign-looking tumors metastasize early and extensively.

Early growths limited to the cervix are locally always curable, and in at least 50 per cent radically and permanently by radium alone. Operative removals are of doubtful value after a radiation cure and owing to sclerosis are technically difficult. In combining radiation and surgery, it is best to follow the radiation by a hysterectomy within a few days, before any complications arise. The ratio of permanent cures in early operable cases by radiation and by hysterectomy is about equal. Radiation is indispensable in many stout, old, feeble, and sick patients, where the primary mortality precludes an operation. The same is true of extensive growths involving parametria, vaginal wall, rectum, and bladder, and glandular metastases.

The direct topical application of radium and implantation is so superior—easier, more direct, and fruitful of results—that in this country the carrying of a cervical cancer to complete cure by external radiation is not countenanced. We feel certain that the delivery of an erythema dose to the cervix, as calculated by the charts of Dessauer and others, exhibiting the distribution in tissues at various depths, will not cure although often relieving pain and other discomforts. To effect a cure in this way, the amount must be from four to six times the erythema dose. Such treatments demand a high skill in cross-firing where x-ray is employed, or an immense dosage with radium. Injuries to normal structures, particularly blood and intestines, occur with untoward and alarming frequency. It is, however, true that extra dosage can be applied by utilizing small fields and radiating the pelvic walls and parametria. We believe that no American has yet cured a cervical cancer in this way, while its chief advocate, Wintz of Erlangen, Germany, has not yet published his results. It



A.



B.

PLATE XIII.—A. CANCER OF CERVIX ONE MONTH AFTER RADIATION. EXTENSIVE SLOUGH PRESENT IN CERVIX.
 B. TWO MONTHS AFTER RADIATION. CERVIX HEALED. (LILIAN K. P. FARRAR, *Surg., Gynec. & Obst.*)

is really a question whether this type of radiation is justifiable except as a palliative.

When the growth is limited to the cervix, the radiation should usually be equally divided between an intracervical and an appositional vaginal portal. Where a gram or more is available 3 gram hours treatment can be given in a single sitting and without serious injury to bowel or bladder. If 100 milligrams or less are used, the radiation should be about 30 per cent more as calculated by the milligram hour dosage. When there is much slough and infection, it is well to cauterize, curette, and give douches for some days before treating; those who are anemic and in bad general condition should rest in the hospital for some days after the treatment. Such precautionary measures are especially important in the infected cases when small quantities of radium and long application periods are used. It appears that infected packs left in several days give rise to much trouble. When the cervix is closed, it is best to treat under gas and oxygen anesthesia. As a rule anesthesia is not necessary or even desirable while the treatment is being applied in the knee-chest posture, facilitating careful and accurate placing of the applicators and thorough screening of rectum and vaginal walls by gold or lead screens and gauze packs, Figure 738. When the vaginal wall is involved the dosage is calculated per square centimeter. In the parametria, especially where there is fixation, implantation is necessary, guided by a finger in the rectum. Occasionally, it is advisable to implant through an abdominal incision. Those who are not anemic or sick can return home after treatment, to report at stated intervals. In implanting, one must avoid coming too close to the ureters. All such patients should be followed up regularly until either a cure results or is found impossible. The "cured" cases should be kept under regular observation for years.

It is impossible absolutely to indicate the limits of radiability for permanent cures are occasionally seen even in very advanced disease. Where there are metastases which cannot be reached one ought not to make heroic efforts to destroy a large local growth. Every operator must learn by degrees for himself the limits of his methods; where cure is impossible, it is wiser to use a mild palliative dosage to alleviate pain, bleeding, and discharge, to prolong life with greater comfort.

Perhaps the most difficult complication to combat in using a heavy dosage in an extensive case is the proctitis following. If mild, it comes on two or three weeks after the treatment and lasts but a couple of weeks, with pressure in the rectum, straining, and passage of mucus. The best treatment is rest in bed with sedatives in the severer cases. In addition to a primary proctitis, some six or eight months after the treatment, a secondary irritation with ulceration may develop, in extreme cases terminating in a fistula. This is due to an obliterating endarteritis of the anterior wall of the bowel; usually there is a smooth healing, sometimes with stricture. Similar, but rarer changes are seen

in the bladder. Now and then the cervix becomes occluded, and a pyometria follows, easily curable by dilatation, drainage, and irrigation; occasionally, hysterectomy is necessary. Strictures of the ureters are curable by dilatation when there is no enveloping cancer.

The initial result of such radiations as estimated within the first year in early cases, is very high. The immediate results in border-line and huge inoperable cases have likewise been high, but as measured by the extended five-year-cure period there are many relapses. The importance of waiting to establish the permanency of a cure is shown in the group reported by Kelly and Burnam in 1915, and reviewed in 1922. In the operables, 100 per cent were well in 1915 for a year or more; by 1922 one-half of these had died of recurrence. Among the inoperables, 25 per cent were cured for a year or more, as far back as 1915, but this percentage seven years later had dropped to 7.8 per cent. It is important to note that the series of 213 cases represented every patient coming to the Clinic when all were treated without exception. Döderlein reports five-year cures in 48 per cent of operable cases in the very early group, in 22 per cent of the advanced operables, and in 6.7 per cent of the inoperables. Similar results are reported by Bailey and Healey, Regaud, Schmitz, Clark, Ward, Lynch, and others. We hope soon to present an extensive series of more recent date, with better average results in each class, and with far fewer complications, the fruitage of a larger, riper experience.

Better results are obtainable by a more intensive study of each individual, the application of more exact methods of dosage in the operables and in the inoperables. We are moreover conscious of a far greater assurance than we had five years ago, as to our ability to treat with a reasonable prospect of cure and, in the advanced stages, of not increasing pain.

Body of the Uterus.—Benign tumors, chiefly polyps and fibroids, are very amenable to radium treatment. The treatment of malignant tumors of the body of the uterus by radiation is much more doubtful of solution. While cervical cancer, even in its early stages, is better treated by radium than by operation, the reverse is true of cancer of the body. The contra-indications to operation in body cancer are its obvious extent beyond the possibility of removal, or general conditions and complications which render anesthesia and operation hazardous or impossible. We will discuss the question of radiation of uterine fibroids and polyps in conjunction with menorrhagia and metrorrhagia. Reference is here made solely to carcinoma and sarcoma.

Histologically, with few exceptions, the cancer is an adenocarcinoma; occasionally an epithelioma occurs in the body by metaplasia; oftener it is due to an extension upward from the cervix. Many, if not the majority, of these carcinomata are of a low-grade malignancy, from the standpoint of clinical and histological structure, and among such low-grade malignancies, cure of a permanent character by operation is the rule. Where the histological charac-

ters are those of Grade IV malignancy, the prospects of cure are greatly reduced, as these metastasize most rapidly and are only curable at the very onset.

The same general laws as to radiosensitivity hold here as in carcinomata elsewhere. Low-grade tumors are very radioresistant, but not so much so as the normal epithelium of the body of the uterus. In addition to the factor of radiosensitivity, it is clinically impossible to determine the exact extent of such growths and to know whether only a part or the entire endometrium is involved, as well as the depth of the extension into the musculi. By reason of this lack of diagnostic precision, accuracy in dosage is impossible. Also, although an extensive slough of a cervical carcinoma need have no bad sequelæ, in the case of a body cancer such an accident is a serious and usually fatal complication. Radiation through the skin surfaces is also less favorable than in cervical cancers. It is true, however, that a combination of mild intra-uterine radiation and thorough external treatment with radium, or if this is not available with deep x-ray, sometimes yields remarkable results in growths of the fourth grade of malignancy. We have seen immediate clinical cures in some very advanced cases, but none permanent. It is also true that in many early body cancers of low-grade malignancy where intra-uterine radiation has been followed by hysterectomy, no lingering trace of the cancer has been discoverable; likewise, we often see patients where hysterectomy is contra-indicated on account of extreme ill health, in whom all bleeding has ceased, the discharge has disappeared, and the general health has improved—some of these have been clinically well for years.

To summarize, the indication for radium treatment in body cancer is inoperability by reason of general or local causes. External treatments are guided by the general principles of deep therapy. In using radium, a distance of 3 inches is maintained from the skin surface and many portals are utilized. The intensity of the treatment is directed toward an estimated lethal dose for the carcinoma. This must often be modified where there is infection, anemia, and other complications. The internal radiation is best given after curettage and under general anesthesia, the effort being made to cover the entire uterine wall. An applicator, such as we use in fibroid tumor radiation, Figure 738, is satisfactory, slightly curved, to allow the fornices to be reached separately, and then moved from place to place. If preferred, the tubes can be tied up separately in rubber cots, and introduced so as to cover the entire cavity. It is rarely safe in cancer of the body to treat for more than 3 gram hours in a single dose. After eight weeks or more, curettage may be carried out and if the disease is still found a second application made, of not over one-half the original intensity and amount.

Primary uterine sarcoma is comparatively rare, while the so-called sarcomatous changes in fibroids are not uncommon. The radiosensitivity varies markedly but is on the average quite as high as in the epitheliomata. The same general principles of radiation should be applied as for epithelioma, and

the indication as between surgical operation and radiation is about the same.

Ovary.—Radiation is of value in the treatment of ovarian tumors but secondary to surgery. We do not believe that it is of any efficacy in benign tumors, except possibly fibromata which have not been tried. In malignant disease the application is principally transcutaneous; occasionally a direct implantation is made through an abdominal incision; rarely, in recurrences on the pelvic floor, the insertion is made through the vaginal vault. Intelligent cross-firing is difficult on account of the likelihood of injuring other organs, especially the intestines, and the problem is indeed often insoluble. Some of the most malignant tumors are, however, quite radiosensitive, especially those in young girls, where often by intelligent radiation (especially in the histologically malignant group) the general health is improved, and an ascites demanding frequent tapping is done away with, and a valued life prolonged for months and years.

In a topical application, limited to recurrences on the pelvic floor, the treatment should usually be by implantation and as described for the cervix. It is well usually to combine the implantation with cross-firing from the vaginal cavity and the surface of the body. We have seen quite large recurrences melt down and disappear in this way. In abdominal applications, heavy treatments may be given in the pelvis to masses fixed and of limited extent. Where there is a general ascites and probable universal metastases or implantations throughout the abdominal cavity, no such large dosage should be given. The general condition, and the blood especially, must always be closely watched. Broken doses are better than the single dose technique. While the usual aim is palliation, some actual cures occur. I cite several:

L. K., age eleven, February, 1918. Severe pain in right groin and hip. Operation for appendicitis revealed normal appendix. Pelvis choked with neoplasm, firmly fixed to pelvic floor involving uterus and both ovaries. Left ovary hard, about 8 centimeters in diameter, and movable, removed and abdomen closed. Microscopic examination: carcinoma of Grade IV. A total of $41\frac{1}{2}$ gram hours radiation given, at a uniform distance of 3 inches, through many portals, tolerated without serious injury to blood or skin irritation. Tumor disappeared completely and has never returned, while she has grown normally to womanhood, and though never menstruating has for some years had severe headaches, and is unable to stand much study or work.

N. A., age twenty-seven, August, 1922. Pain in left side and back. Mother of two children. Operation for "a growth of left ovary," and ovary, tube, and uterus with the tumor removed in April, 1922. Histology: Adenocarcinoma. When seen in August, mass in original site of disease size of grapefruit, dense and hard. General condition good. Treatment: At 4 inches from skin, 40 gram hours radiation within a few days, without ill effect. In a month the tumor had diminished to one-third size and in two months it had disappeared; four years later in excellent health, without recurrence.

N. F., age forty-six, October, 1925. Enlarged abdomen; general health good, mother of five children. June, 1925, suddenly attacked with pain in abdomen. Operation, malignant cystic carcinoma of the left ovary removed, leaving large masses in pelvis. Following operation, weekly tapings. At our first examination, considerable fluid in abdomen, and large solid mass filled pelvis almost to umbilicus. At a uniform distance of 3 inches by broken dose method 30 gram hours given through many portals; improvement from the first; fluid disappeared without any further accumulation. She has gained weight, is rosy in color, feels perfectly well; examination, October, 1926, no evidence of large tumor on bimanual examination; so far a complete clinical cure.

While such recoveries are exceptional, marked clinical improvements are common; it is, therefore, our opinion that these patients should be studied from every standpoint of type of growth and method of treatment. Such experiences convince us that when the histological examination of an ovarian tumor reveals a high grade of malignancy, the patient should always be given a thorough postoperative prophylactic radiation treatment.

Vulva.—A great variety of benign and malignant new growths, from their superficial location, are usually discovered early in their development.

Of the various benign tumors, warts and angiomas are especially suitable for radiation. The latter are usually seen in the very young; warts, also common in children, are found at any age. For warts, a single 40 per cent erythema dose by a suitable flat applicator is nearly always effectual. The angiomas, as elsewhere extremely sensitive, are usually of the thick variety; port-wine stains, like those seen on the face, are rare. The indications are a flat applicator and not more than 25 per cent of the erythema dose, great care being taken to distribute it so that the periphery receives as much as the central areas. It is wise always to await the full effects of the treatment which may be after several months, as a single dose often effects a cure. Overtreatment causes severe sloughs and leads to telangiectases and skin atrophies and disfigurement never observed after a proper small dosage.

We have seen spindle-cell sarcoma of the vulva in two cases. Both patients had been operated on repeatedly and treated with x-ray. In the one which was growing, satisfactory results followed implantation of bare emanation points according to the technique of Quick. There was a recurrence after a year involving the rectum and bladder. The second patient (H. B., aged thirty) had the left labium removed for a small and localized sarcoma. There was a recurrence almost immediately and when seen, July, 1921, a hard, indurated fixation, involving the scar and extending up to the pubic bone. There were no glands evident. A $1\frac{1}{2}$ hour treatment was given to the affected area at a distance of an inch, and within a month the growth had disappeared. In April, 1922, a small nodule recurred which was removed. The patient was given 2 gram hours at $\frac{3}{4}$ inch distance over the affected part and the groin was

also radiated. At intervals she has been seen and radiated further. At present she is living and well, four years after the onset.

Occasionally an adenocarcinoma arises in the sweat-glands, closely resembling breast carcinoma. The common growths are, however, epitheliomata. There is a high percentage of a low-grade pearl-forming type, originating in patches of psoriasis, kraurosis, eczema, or other chronic inflammatory lesions. In the presence of widespread surrounding inflammation, effectual radiation is greatly hindered by the unduly painful reactions. The actual cure of the lesion is easy where the dosage is adequate. Thick lesions should be treated by implantation and superficial ones by flat applicators; if the glands are enlarged, then by implantation. The best plan is distance radiation for gland regions treated prophylactically. This field is *sub judice*. Radium or x-ray is the only present method for the widespread inoperable lesions unless we succeed as seems likely in using high frequency electrosurgical procedures. In small lesions, especially if complicated by inflammatory accompaniments, surgical extirpation is less painful, more certain, and yields excellent results. When the inguinal glands are involved, surgery is better if they are localized and movable; fixed and multiple glands are better treated by implantations and flat plaques on the surface.

In radiating, great care must be taken never to cause a dermatitis or erythema. When pruritus frequently occurs without itching elsewhere, and without any visible or microscopic skin lesion, almost any form of mild radiation gives at least temporary relief, and occasionally much more. Compresses of carnotite, the mineral containing radium, often allay the itching so long as they are kept in place, a remarkable fact considering the small amount of radium present in the mineral which usually only carries about 80 milligrams of radium to the ton. In using radium it is convenient to make the application at $\frac{1}{4}$ inch and to give about 25 per cent of an erythema dose to the whole affected area. X-ray in an equivalent dosage seems equally effectual.

Fibroid Tumors of the Uterus.—Early in our experiences with radium we turned our attention to uterine fibroids. A number of patients treated early in 1913 were reported along with those of hemorrhagic uteri at the American Medical Association in Atlantic City, June, 1914, and since then we have treated many hundreds. The debate is still animated as to the relative merits of radiation and surgery. The chief arguments advanced for surgery are that the tumor is removed at once, that unsuspected conditions of the tubes and ovaries and of other abdominal organs (especially the appendix) are often found and treated at the same time, that the function of the ovaries is maintained even though sterility follows the hysterectomy, and that in young women it is often possible by myomectomy to conserve the possibility of child-bearing. The chief arguments for radiation are the absence of primary mortality, the painless procedure, no hospitalization, a quicker return to active and useful life, results as to bleeding and pressure as good as with surgery, and

the complete or almost complete disappearance of the tumor in a large proportion, not to grow again. The ablation of the ovarian function entails no bad psychic or somatic results, and except for hot flushings there is but little complaint, the patients almost invariably feeling much better. Fibroids have also completely disappeared without disturbing the ovarian function, and in a few cases normal pregnancy and the birth of a normal child have occurred.

The decision to treat or not by radiation should be reached after thorough conscientious examination and consideration of all the physical, economic, and social problems involved. Some would limit the radiation to tumors not larger than the adult's fist; others to women beyond a certain age; yet others to tumors causing hemorrhage. It is generally agreed that where it is not possible to determine positively whether or not the tumor is fibroid, the indication is for operation; a dilemma of this type is commoner in the larger tumors. Intra-uterine radiation is contra-indicated when there is a complicating pelvic inflammatory disease; it is, however, feasible here to treat by abdominal external radiation either with radium or by x-ray.

Usually, radiation sufficient to effect the complete and permanent disappearance of a fibroid must also produce a permanent artificial menopause. A treatment which causes an amenorrhea of but a few months may suffice greatly to reduce the size of tumor, but with the return of active menstruation it is likely to grow again. Some technicians, notably in Germany, ascribe the reduction in size of fibroids entirely to the effect upon the ovaries. It is well-known that after the menopause many fibroid tumors shrink and that shrinkage also follows double ovariectomy. Such a decrease, however, is far less than that which takes place after radiation and occurs in a much smaller percentage. Furthermore, in some, as a result of radiation, fibroids disappear without cessation of menstruation, and in the majority of fibroids treated after the menopause there is a marked reduction in size. It is logical, therefore, to conclude that the action is a direct one on the fibroid tissue.

After an exposure to radium, sufficient to bring about an amenorrhea, the reduction varies greatly in different cases. In some there is a complete resolution in three or four months; in others the more gradual decrease extends over a year or more; in about 10 per cent there is little effect on the size of the tumor. In more than 50 per cent there is a complete disappearance, and this applies to large as well as to small tumors. In reviewing our tumors larger than a five months' pregnancy, which most authors regard as contra-indicating radiation, we find that more than 60 per cent completely disappear.

With the disappearance of the tumor, pressure symptoms are relieved, and even when the tumor shrinks without disappearing these symptoms are usually absent when the full effects have been realized.

The control of bleeding is beyond all question; generally a complete amenorrhea is quickly secured, in about 40 per cent from the day of treatment, and in the remainder from thirty to sixty days after the treatment. Menstruation

after radiation is due to the persisting of corpora lutea already formed when the treatment was given. Very heavy radiation destroys these corpora but this is unnecessary and should not be resorted to as a rule.

Fibroids in the musculature of the uterus show quicker reduction than the subperitoneal. Submucous polypoid tumors should be removed surgically; the same rule is applicable to sloughing submucous tumors. These excepted, all others are favorably influenced by radiation.

As a preliminary, unless there is some specific contra-indication, the patient takes an anesthetic for a thorough pelvic examination including curettage. The

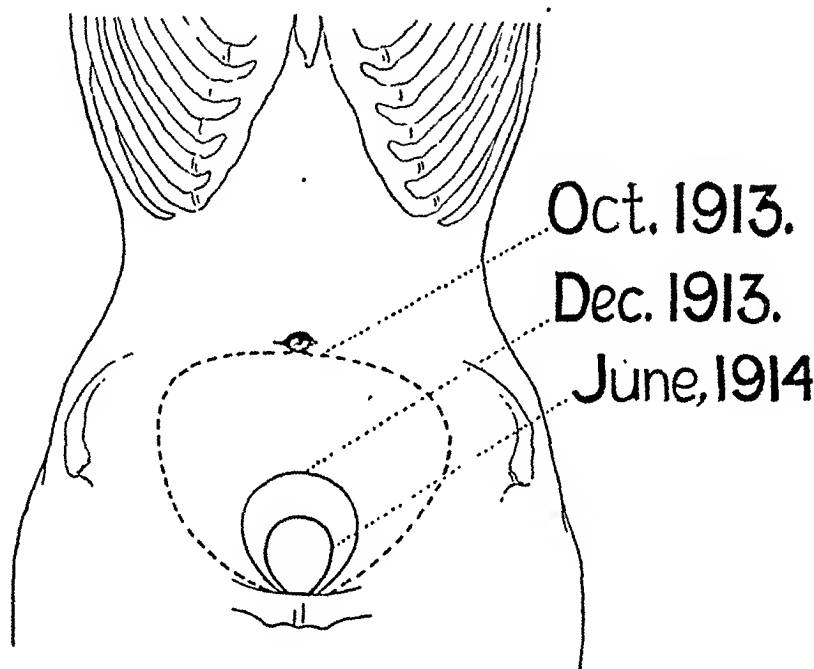


FIG. 739.—DIAGRAM SHOWING PROGRESSIVE DISAPPEARANCE OF FIBROID FIRST TREATED OCTOBER, 1913.

Tracing made with India ink, or dermatographic pencil, and transferred to crinolin accurately applied to abdomen.

size and location of the tumor should be accurately charted, preferably traced on crinoline, Figure 739, and the general condition of kidneys, blood, blood-pressure, condition of heart investigated and recorded.

An intra-uterine treatment may be given with or without anesthetic. The preparation is as for an ordinary curettage; the cervix is dilated with the Hegar graduated sounds, and the radium introduced either as a sound or in tubes with strings attached and left in place until 1,500 milligram hours (1.5 gram hours) are given. Care must be exercised to utilize only gamma-rays; cutting off the soft secondary radiation from the screen by using an applicator covered with rubber or other soft substance. On our own sounds, Figure 740, we use a coating of wax and find it satisfactory. The occasional patient who does not cease to menstruate after this dosage should receive additional radiation from the abdominal side. Where it is important not to stop menstruation permanently, the dose should not exceed 700 milliecurie hours. We have never

seen a permanent amenorrhea where we have thus limited it. It is often advisable to give even less than this amount; frequently even so small a treatment as 300 millicurie hours will secure a satisfactory temporary amenorrhea. It is well after treating to insist on rest in bed for a day or two. Occasional patients complain for a month or more of slight abdominal discomforts, and a leukorrheal discharge is common for eight or ten weeks.

Treating each ovarian region at a distance of 3 inches from the skin, yields results similar to an intra-uterine treatment if one gives a total of 20 gram hours radiation; by using the lead cylinder and four portals at a distance of 1

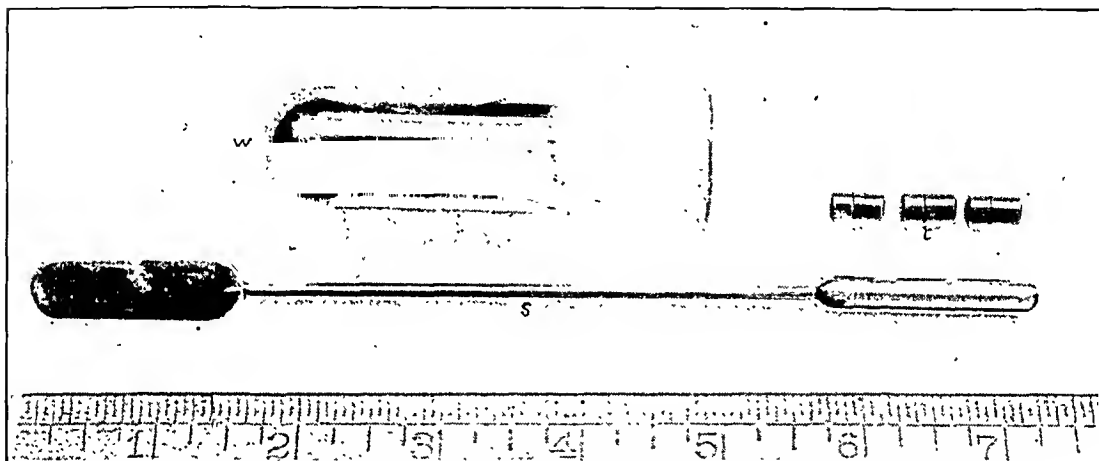


FIG. 740.—SOUND, TUBES, AND WAX FOR INTRA-UTERINE TREATMENT OF FIBROIDS AND BLEEDING CASES.

Each small tube of brass, 1.5 millimeters thick, contains glass capsule of radium emanation. Sterilized in pure carbolic and alcohol and placed in sound sterilized by boiling. Before use, this is dipped in sterile wax furnishing an even, smooth coating, which reduces secondary radiation from surface of brass. Thickness of wall of sound is 2.5 millimeters.

inch from the skin over each ovarian region, the amount of radiation can be reduced to 10 gram hours. While devoid of pain, and not calling for anesthesia, nor causing leukorrhea, and applicable to cases with a chronic inflammatory trouble, this method has yet its disadvantages, in that it does not affect the bleeding as promptly nor does it on an average reduce the tumors as rapidly or as completely as the intra-uterine avenue; it causes more nausea; in the extremely anemic cases, it has a more depressant effect on the blood. However, these deleterious effects are less than those resulting from the deep x-ray therapy which we believe should be limited to those in fairly good general condition, without any grave secondary anemia.

Menorrhagias and Metrorrhagias.—In securing permanent amenorrhea, radiation is almost an ideal 100 per cent method. It is an opprobrium upon surgery to feel compelled to advise hysterectomy simply because curettage and local and general treatments have failed; it is here that radium offers the ideal alternative, applying to all bleedings near the menopause and where the preservation of the reproductive function is not important.

The diagnosis and treatment are as described for fibroid tumors.

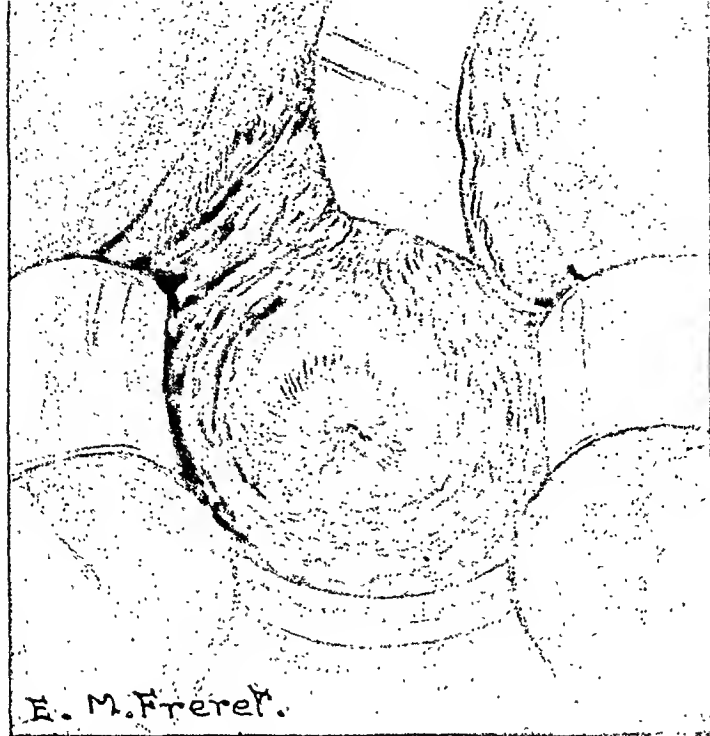
By grading the dosage down, it is possible at times to reduce menstruation without stopping it, and again to stop it temporarily to return in a few months or a year quite normal. A child born after such radiation is normal. This interesting observation has been made repeatedly with a temporary sterility overcome from the standpoint of both parents. We do not, however, advocate radiating in young girls unless the indications are imperative, such as avoidance of hysterectomy, or months or years of invalidism from anemia. In reviewing the curettings from girls with menorrhagia, we were surprised to find almost two-thirds without any hyperplasia or polypoid endometrium; several had definite blood dyscrasias associated with purpura. These latter recovered during the months of amenorrhea and had a normal blood-picture and menstrual function on its return.

Complete cessation of menses follows the intra-uterine administration of radium from 1,000 to 1,200 millicurie hours. The only discomfort noted during the application is an occasional malaise and cramps. The equivalent treatment given through the abdomen over each ovarian region is applied at 7 centimeters from the skin for 6 to 8 gram hours.

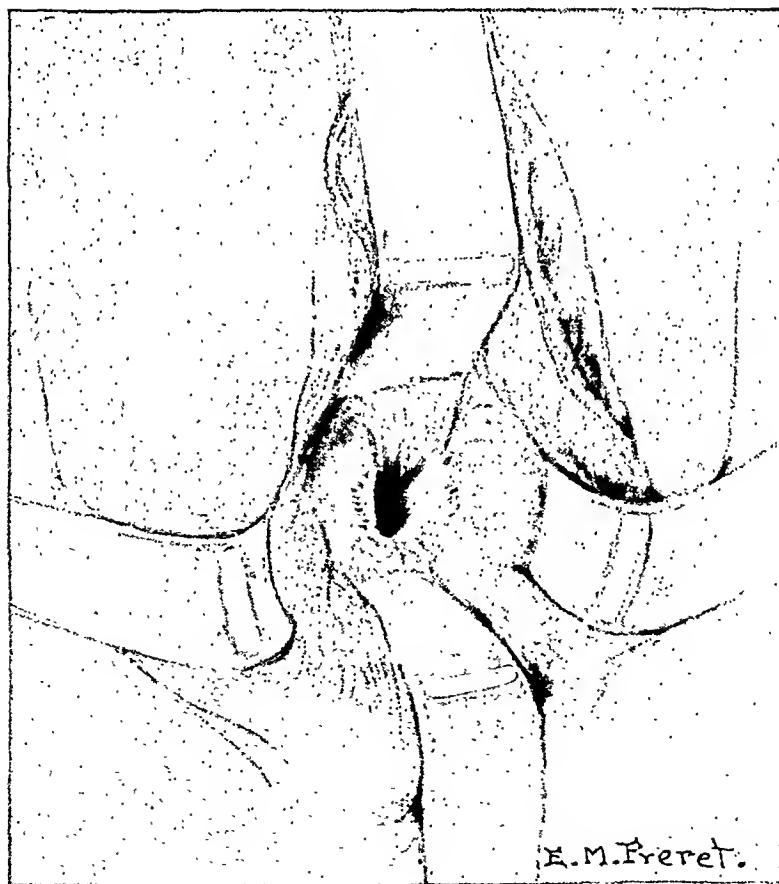
We have treated 144 of these bleeding cases at an average of the youngest, forty, the oldest, sixty-seven. In eighty-five, there was an immediate cessation of the hemorrhage with no subsequent menstruation; in fifty-four of the remaining fifty-nine, thirty-eight had one period and eleven had from two to four; of five treated by external radiation, one menstruated four times, one twice, and two once, while another had a radical operation done elsewhere within a month.

Sixty-two had moderate hot and cold flushes and nervousness, lasting from two months to three years; in three, the symptoms were severe extending over five years. There was no subsequent arthritic trouble, nor elevated blood-pressure. A pyometra developed in three and was relieved by dilating the cervix. In one, an acute pelvic inflammation supervened and a radical extirpation was done within two months.

The artificial menopause seems in no way worse than a natural one. The wrecks we used to see after double ovariectomy do not develop. This seems not so much attributable to any peculiarity of the radium menopause as to the fact that in the early days of gynecology many ovariectomies were done on extremely nervous and mentally disturbed patients, and instead of the relief expected from the surgical operation, they found added to their miseries hot flushings, great depression, and the sense of mutilation. As a rule, the so-called vasomotor disturbances from stopping menstruation are less in the young than in older patients, and occur in one form or another in about 60 per cent, and last from a few months to several years. With exceptions, they are usually worse in the temporary amenorrheas, especially just before the return of menstruation.



A



B

PLATE XIV.—A. CANCER OF CERVIX THREE MONTHS AFTER RADIATION. CERVIX PALE, BEGINNING TO SHOW CONTRACTION.

B. SIX MONTHS AFTER RADIATION. LIPS HAVE ENTIRELY DISAPPEARED, VAULT OF VAGINA AND VAGINAL CANAL NARROWED. (LILIAN K. P. FARRAR, *Surg., Gynec., & Obst.*)



Dysmenorrhea.—Menstrual cramps and local pelvic pains are often relieved by intra-uterine or by through and through treatments, with a dosage only a fraction of that required for amenorrhea. It is perhaps wiser here to exhaust other methods first. The dysmenorrheas in young girls are frequently relieved by improving the general health, by suitable exercises, rest and regulation of the alimentary function, by dilatation of the cervix, and mild sedatives coupled with patience. In older women the problem becomes rather one of relieving the intense nervous reaction at the period. In case the monthly symptoms are so intense as almost to cause invalidism, while the patient in the intermenstrual period is free from discomfort, it is sometimes justifiable to stop the menstrual function temporarily. The results in this group (exceptions duly noted) have been excellent. If after such a temporary cessation, upon the return of the function the old symptoms recur, the patient herself will often demand a permanent amenorrhea.

Sterilization.—Certain sundry organic diseases, such as tuberculosis, chronic pyelitis, heart incompensations, Bright's disease, diabetes, as well as certain grave mental troubles, at times fully justify sterilization by the method advocated in treating uterine fibroids and bleeding cases. We resorted to this chiefly in pulmonary tuberculosis, finding it valuable afterward in the general treatment. Where it is desirable to preserve fecundity, the treatment adjusted to a temporary amenorrhea is wise.

Tuberculosis of the Pelvic Organs and Peritoneum.—Combined with other therapies these cases are astonishingly affected by radium. Not over 15 per cent of a skin dose is given with four-week intervals between treatments, with a general application of ultraviolet light, a great adjuvant. Under such a régime the masses shrink, the pain disappears, and the ascites is usually absorbed. Similar results are also secured with the x-ray. In addition to a general application to the peritoneum, the dosage to the ovaries should be carried to the production of amenorrhea; the elimination of the recurrent menstrual congestions is most helpful. Let me cite a typical case of a woman, very ill with a generalized tuberculous peritonitis.

F. L. B., aged sixty, March, 1924. Menopause at forty. Never pregnant. Complaint: Weakness and swollen abdomen. For about a year gas in abdomen, indigestion, vague pelvic pains, and a temperature up to $100\frac{1}{2}^{\circ}$ nightly. No cough; no pulmonary symptoms. X-rays of chest and abdomen negative. Abdomen greatly distended with fluid; no definite masses palpable. March, 1924, abdomen drained through small incision, removing 3,000 c.c. of clear straw-colored fluid. Nodules found scattered throughout the abdomen, and tubes, ovaries, and uterus involved in solid mass. In ten days fluid formed again, and temperature continued. Radium treatment inaugurated, distance 4 inches, over each quadrant, in five successive doses at intervals of forty-eight hours; total of 17 gram hours. Marked reaction; the treatment was twice as strong as we now advocate. The fluid disappeared quickly while temperature

and general condition grew worse, and improvement only began after two months, with a steady decrease in size of palpable masses, and gain in weight and strength; at the present, two and a half years later, she is of normal weight and is well.

Chronic Pelvic Inflammatory Disease.—In tuberculous and inflammatory lesions of the pelvis, no intra-uterine treatment should be given, as it is likely to induce an acute exacerbation easily fatal.

It is possible here with external radiation, in broken doses, to secure a complete amenorrhea without upsetting the patient while affording great relief, inasmuch as not a few with chronic infections suffer mostly at and about the menstrual period.

Where a conservative nonoperative treatment is indicated, the customary measures of rest in bed, hot douches, etc., are greatly aided by a radiation amenorrhea. It is usually best to adjust the dosage to a temporary sterilization. Rest from the periodic congestions gives nature a chance to heal and yields results as good as by other conservative plans. Suitable cases should be selected with care and kept under close observation.

CHAPTER XLV

X-RAY

ROBERT E. FRICKE ¹

EQUIPMENT

DOSAGE

APPLICATION

Diagnosis

Therapy

MENORRHAGIAS

UTERINE FIBROIDS

DYSMENORRHEA

STERILIZATION

STIMULATING DOSAGE

SARCOMA

CANCER

1. *Cervix*

2. *Vagina*

3. *Vulva*

4. *Body*

ADENOMYOMA

TUMORS OF THE OVARY

PRURITUS VULVÆ

CHRONIC PELVIC INFLAMMATORY DISEASE

TUBERCULOSIS OF TUBES AND OVARIES

Although the application of x-ray to medical needs followed almost immediately Roentgen's announcement (1895) of his discovery, few then could have anticipated the world-wide and continuous investigations surmounting the innumerable and seemingly impassable obstacles which ultimately have placed in our hands the fine instruments we now use in producing and accurately measuring these invisible rays. While much has been settled both in regard to physical facts and biological effects, there is still a large terrain for further exploration; it is safe to prophesy that present methods will be antiquated in a few years. The status of x-rays as a diagnostic and therapeutic agency at present, in so far as gynecology is concerned, is fairly comparable to that of surgery at large in the early nineties of the last century.

From a diagnostic aspect, gynecology depends less on x-rays than either of the closely allied specialties, obstetrics and gynecological urology; on the other

¹ Fricke touches here and there on the value of radium as well as his theme, x-ray therapy. I have let this stand as the testimony of an independent witness and because the combination of x-ray and radium is so often more effective than either alone. H. A. K.

hand, from the standpoint of treatment, the x-ray in gynecology far surpasses its utility in either of these fields.

In the therapeutic field in gynecology, x-ray has enjoyed much greater popularity in continental Europe than in Anglo-Saxon countries, and consequently European clinics are better equipped. The status of the so-called "deep x-ray" therapy rests upon the foundation built in the gynecological clinics, Germany notably being the leader with Krönig of Freiburg preëminent among the pioneers.

Space precludes technical details of transformers, tubes, table arrangements, safety devices, measuring instruments, easily found in the numerous excellent special works and best understood by actual workers in a modern laboratory or clinic, as the roentgenologists prefer to call the x-ray department.

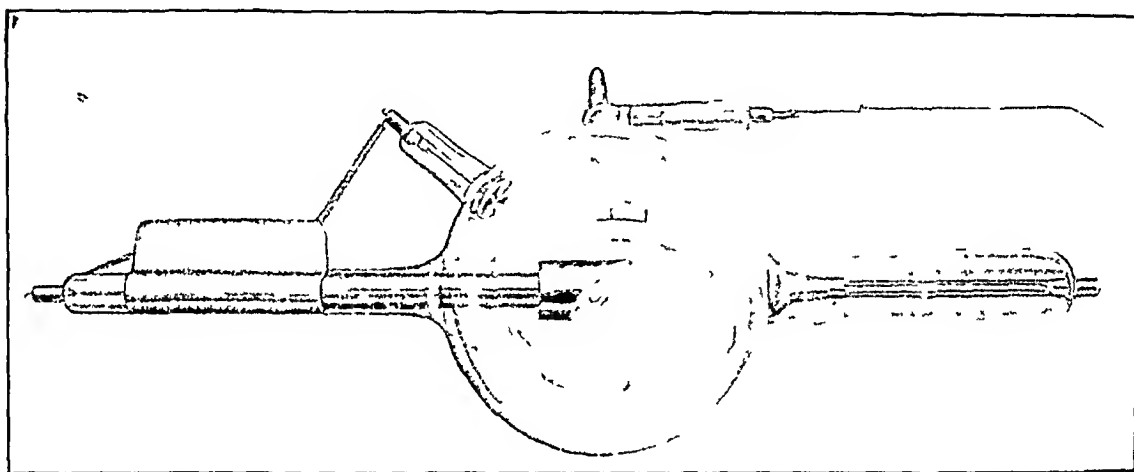


FIG. 741.—GAS TUBE.

Electrons are generated from residual gas in tube.

The physics, as well as the biological effects of radiation on human tissues, have been mentioned in Chapter XLIV; a few addenda only are called for.

X-rays belong to the same order as visible light and the gamma-rays of radium, the only physical difference being one of wave-length. Ordinary light-waves range through a scale varying from 7200 to 4000 Angström units, while the x-rays register from 500 to 0.06 of the same unit; gamma-rays are still shorter. While the great physical principle of the conservation of energy seems to preclude any action of rays in passing through materials, except in proportion to the amount of absorption; nevertheless, there are many actual differences between x-rays and gamma-rays. These are of such a character that it seems safe to say that if radium were cheap and abundant, it would largely replace the x-ray in the therapeutic field. Unfortunately, because of economic reasons and for convenience the x-rays must be used frequently.

While it is not practicable for the gynecologist or the general practitioner in sympathetic touch with gynecology to master the technique of radiology, some familiarity with the elements of the problem is none the less desirable

and perhaps urgent for the sake of the radiologist in widening his domain, assessing results, and correcting errors.

To mention briefly a few of the fundamental principles:

The apparatus suitable for radiographic work in gynecology is identical with that for radiographic work generally. Such apparatus is not capable of being used for therapy where durability, long continuous usage, and the highest possible uniformity of output is called for. A beam of x-rays is a mixture of rays of many different wave-lengths and with varying powers of penetration. The wave-length depends on the speed of the electrons passing from the cathode to the target (anode) of the x-ray tube, and this in turn depends upon the voltage used to excite the tube. In addition to the radiation directly dependent on and proportional to voltage, an important influence is associated with the type of metal used in the target, as each metal gives off its own characteristic

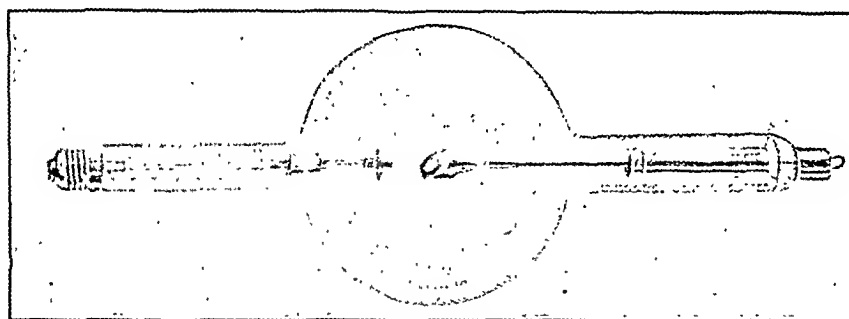


FIG. 742.—COOLIDGE HOT-CATHODE TUBE.

Electrons emitted by heated cathode.

or K radiation. If the voltage is sufficient to excite this specific radiation, it constitutes a large percentage of the total amount of rays produced. Owing to its infusibility and comparative cheapness, tungsten has practically replaced all other metals in targets. The K radiation of tungsten begins at 80 kilovolts. It is possible so to rectify the current coming from the closed-core, oil-insulated transformers; that only high voltages pass through the tubes, but this does not remove the K radiation which is done by interposing metal filters, usually of copper and aluminum, between the patient and the tube, serving to absorb the softer rays and K rays. About a millimeter of each metal is required, with the addition of several millimeters of rubber or leather to remove soft secondary radiation originating in the screen itself.

X-rays used in therapy correspond to peak voltages ranging from 150 to 250 kilovolts; the higher the voltage, the shorter the wave-length, the greater the penetration, and the greater the proportion of the depth dose to that of the surface dose. The quantity of x-ray produced is directly proportional to the amperage and to the square of the voltage. The absorption in water or in tissue of a bundle of hard x-ray is almost exponential, in spite of the fact that the constituent rays are not homogeneous; this means that for each unit of tissue

depth, the same fraction of rays applied to it is absorbed. In practice, charts based upon experimental measurements are of great assistance in calculating dosage. While these are procurable from the apparatus manufacturers, it is better to construct one's own chart from the machine and tube in actual use.

Equipment.—The hot cathode, high vacuum tube introduced by Coolidge, in 1913, on account of greater constancy and durability, now almost completely replaces the older gas tubes. There are a number of transformers in the market which readily and constantly stand 200 kilovolts, and these tubes can be run hours on end for days with but slight variation. The amperage employed usually varies from four to five milliamperes. In 1923, Coolidge (*Am. J. Roentgenol. & Rad. Ther.*, Nov., 1923, 10) reported a water-cooled treatment tube, which carries from 30 to 50 milliamperes of current and voltages up to 250,000. The greatly increased quantities of ray available with this tube

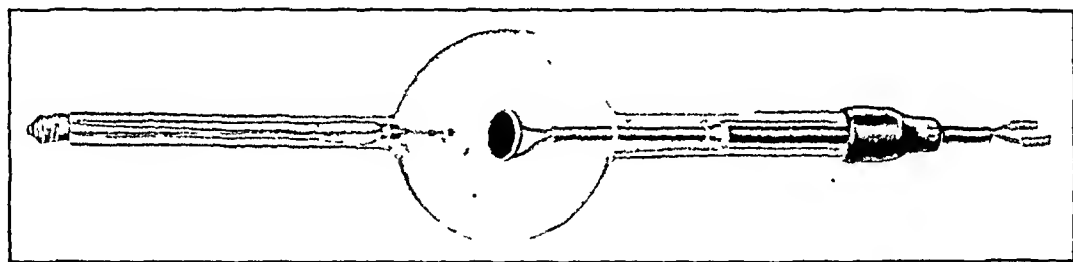


FIG. 743.—COOLIDGE WATER-COOLED TUBE.

Heavier amperage and voltage used to excite this tube, producing more penetrating rays and shortening exposures.

have reduced the duration of the exposures down to about one-fifteenth of the exposure necessary with the smaller tubes for a similar dose. This not only adds immeasurably to the convenience of the treatments but also makes treatment possible for those who could not bear the long hours of exposure previously necessary. The effects are just as good, and such disagreeable sequelæ as nausea and lassitude are much less pronounced, given equal dosage.

Dosage.—The first biological dosage, the skin erythema, is still our standard. Originally thought to be uniform and fixed, it is now known to be a very variable factor; the skin reaction of different parts of the body of the same individual varies considerably, and there is a marked difference between individuals in their response to the same dosage. The thin-skinned and blondes are less tolerant. A skin which is inflamed, eczematous, or hyperemic is much less resistant than the same skin when normal. In addition to these substantial variations, roentgenologists, themselves, differ as to what is an erythema dose. Where the dosage is given in absolute or R units, variations from 700 to 1200 R units have been named by observers as an average erythema dose. It is also a fact that an erythema dose as measured in R units is much smaller with soft than with hard rays. In my experience, an average dosage producing a slight reddening of the skin in about twelve days and leaving a slight browning per-

sisting for months, usually with depilation, is 1000 R units. The Bureau of Standards in Washington has undertaken to standardize apparatuses, and the effort is being made to secure international uniformity. In this we follow the lead of the Reichs Anstalt in Berlin.

In a given machine, when the erythema dose is fixed, it can be reproduced constantly if it is checked by ionization measurements. Excellent apparatuses are the ionoquantimeter of Friedrich and the ionization chamber and galvanometer of Duane.

The proper treatment limit through a single portal (selected area of entrance) is the erythema dose. If one exceeds this, there is a risk of a severe burn and injury to the integument. With reasonable care under present conditions, serious injuries are rare. An interval of at least six weeks should elapse before treating again through the same skin area.

It is obvious that in gynecology, the beam must be directed so as to include the region affected. Owing to the unlimited quantity of x-ray available, it is both possible and practicable to use greater focal distances than with radium, while the same law of diminution of intensity in inverse proportion to the square of distance holds good. The convenient distance of 50 centimeters for x-ray work has become almost standardized in deep therapy. It is not possible to pass into the depths of the body through a single portal a dosage equivalent to that received by the skin. This difficulty is overcome by cross-firing from the surface to any definite fixed volume in the depth through portals on the front of the body, on the back, and on the perineum.

Seventy per cent of the skin erythema dose delivered to the ovaries causes complete atrophy of the follicles and permanent sterility. One hundred and seventy per cent was for some years held in Germany to be the lethal dose for cancer, but we have learned that the cancer dose from the lethal standpoint varies greatly and depends on the type of cell, while the sarcomata dose is even more variable, often being as much or more than that of cancer.

As developed in connection with the radium, the method of giving a particular dose can be varied greatly. Our present tendency is to avoid the heavy single-sitting treatment which originated in observations upon the superficial skin epithelioma best handled by one curative dose. This has proven too vigorous and unnecessary in the ordinary gynecological procedure, where repeated daily fractions up to the full dose are much easier for the patient and apparently equally effectual in most conditions. Say, for example, a definite dosage is settled upon, then from one-quarter to one-tenth can be given daily, or, again, on alternate days, until the total is delivered.

The size of the portals used in cross-firing vary with the extent of the disease and its volume. Where one involved parametrium, as in cervical cancer, is the objective, cross-firing with small 10 centimeter portals is most effectual. On the other hand, in treating large fibroids or ovarian malignancy, wide portals of 20 centimeters are preferable. In carrying out any treatment after definite

and careful study of the topographical relations and of the general condition of the patient, a definite plan should be decided upon and adhered to just as in surgical operation.

In addition to injuries of the skin, the possibility of injuries to the bowel and particularly injuries to the blood-forming organs must be weighed and taken into account.

Application.—As stated, x-ray is both an instrument for diagnosis and for treatment.

DIAGNOSIS

A pelvic tumor can frequently be shown in an x-ray plate; dermoid cysts and calcified fibroids can be determined. The principal and most important usage, however, is in connection with pneumoperitoneum (Chapter XLVI). In doubtful cases, pregnancy can also be differentiated. By the injection of lipiodol, the surface characteristics of the interior of the uterus can be visualized, and cancer, fibroid tumors, and maldevelopments discovered. In gynecological urology, x-ray has perhaps its most important and indispensable position as a diagnostic agent.

THERAPY

As with radium, the most striking field for treatment is in fibroid uterine tumors, in menorrhagias, and in conditions where it is desirable to establish amenorrheas or sterilities. In treating cancer of the cervix and vagina it holds a far less important place than does radium. I shall consider briefly and in order the various conditions which in our experience can be satisfactorily treated by x-ray.

Menorrhagias.—The menorrhagias of young girls are best treated by radium; it is very doubtful whether x-ray should be used in cases where it is desirable to produce only a temporary effect, as it acts principally on the ovaries with destruction of the follicles and not infrequently menstruation returns with equal or even greater bleeding. This is in striking contrast with radium and is probably attributable to the direct action of the latter on the lining of the uterus. Complete amenorrhea of a permanent character is obtainable in most cases by the application of an erythema dose of 1000 R units through two 20 by 20 centimeter portals, with one center on the pubis and the second center on the counterpoint over the sacrum. If the broken dose method is employed, the patient need not be confined to the hospital. This treatment is to be employed when a permanent amenorrhea is the objective, as in the excessive bleedings near the menopause. The end is attained usually in two months. The after-bleeding is apt to be more pronounced than where radium is used. The results also are not quite so certain, and a second treatment is often necessary. In very anemic women, therefore, radium is preferable, both for this reason

and because the x-ray affects more profoundly the blood-forming organs and makes them slow in recovery. One can, of course, combine x-ray external radiation with intra-uterine radium in any percentages desired. The menopausal and other disturbances following are much the same as those observed with radium alone. There is a distinct advantage in the x-ray when the cervix is infected or in the event of any pelvic inflammatory condition. Judicious applications in broken doses avoid the disadvantages and complications following radium.

Uterine Fibroids.—The effects of x-ray and radium on uterine fibroids are closely analogous. Reduction in the size of the tumors is much more rapid from radium but in the end may be just as complete with the x-ray. The dosage and technique are similar to those for menorrhagia, but it is usually necessary to give a second course of treatments. Submucous, polypoid, and calcified fibroids are not amenable. Wherever there is a reasonable doubt as to the diagnosis, surgery is indicated, as occasionally in the differentiation of a fibroid and an adherent ovarian tumor. Of the large uterine fibroids, only about 40 per cent disappear completely. After the establishment of the amenorrhea, the shrinkage of the tumor may go on for a year or more; some, however, cease to grow but linger indefinitely *in statu quo*. The presence of pus contra-indicates the treatment by x-ray.

Dysmenorrhea.—In patients nearing the menopause with a dysmenorrhea characterized by pelvic pains, or where nervous symptoms associated with the menstruation are pronounced, a sterilizing dose often gives complete relief. In dysmenorrhea in young women, especially the cramping type, x-ray in connection with dilatation is often effectual where the operative procedure alone is unsatisfactory; here not over 6 per cent of the erythema dose should be applied to the ovaries, most conveniently done through a large central suprapubic abdominal portal.

Sterilization.—For complete sterilization, the x-ray is our simplest procedure, applied as in the control of hemorrhage.

Stimulating Dosage.—There is considerable dispute over the stimulating effects of the x-rays in small quantities to cells and organs. It may be that there is no direct stimulating effect, but it is almost certain that the injury done by the x-ray does produce stimulative tissue changes, as is well shown where insufficient treatments are given in cancer, as well as in the irregular bleedings and menstruation observed in women workers exposed over long periods to x-ray or radium radiation. It also appears in giving from 6 to 10 per cent of an erythema dose to the ovaries of young women with functional amenorrheas, when at least half experience a resumption of their normal menstruation. This applies to women with uteri of normal size and with normal ovaries. Women with atrophic ovaries are not benefited. Such treatments should be given in conjunction with gland therapy and general hygienic measures.

Sarcoma.—Sarcoma of the uterus except as found in fibroids is happily rare. It is quite variable as to histological type and radiosensitivity. Many cures have been reported through x-radiation. They are best treated like cancers with a combination of x-ray and intra-uterine radium. Most of them are inoperable when first seen and should invariably be given ray therapy. In an early operable case, a combination of ray therapy and operation is indicated. Curiously and unfortunately, some of the sarcomata approaching ordinary fibroids in histological type are the most malignant and the least radio-sensitive.

Cancer.—1. *Cervix.*—The value of external x-radiation in cancer of the cervix is difficult to estimate. The war-time work of Wintz and Seitz in Erlangen was full of a promise which has never been realized, and, again, after the war, the literature was filled with so-called Wertheim's x-ray treatment. So far as we are aware, there has never been, in America, a single cure of cervical cancer by x-ray alone; there is, however, no doubt that Wintz and Seitz in Erlangen and Warnecross in Berlin did dissipate cervical epitheliomata by external radiation alone. It is possible by special adjustments and specula to radiate the cervix directly with x-rays, but by no means as conveniently as with radium; also, it would appear that the x-ray cures have only been wrought in operable cases. Wintz's technique was by multiple cross-firing and giving the lethal dose to one parametrium, then to the cervix, and then to the other parametrium. By using small portals and by cross-firing, a most difficult technique, he was able to put into the depths a 170 per cent erythema dose. Most of these patients suffered from a marked subsequent anemia and required transfusions; injuries to the rectum, small bowel, and surrounding parts were not uncommon. No statistics covering long periods have been published. It does seem, however, that a reasonable procedure in inoperable parametrial extensions is to combine topical radium applications and implantations with x-rays via abdomen. It is desirable under such conditions to apply the x-ray dosage accurately, avoiding so far as possible radiating the central plane of the bladder and rectum. In advanced cases with severe pain, x-ray is often a most valuable palliative, relieving pain and discomfort. As with radium, it often prolongs life and mitigates the exitus.

2. *Vagina.*—This condition is probably best treated by radium as x-ray is of less value.

3. *Vulva.*—Cancer of the vulva, if inoperable, is sometimes as amenable to x-ray treatment as to radium. The principles controlling the treatment of skin cancer should be employed; with careful protection of the surroundings, a good exposure of the growth, and the x-ray tube brought within 20 centimeters, by using light, almost unfiltered rays, or rays passed through a few millimeters of aluminum, and by exceeding the erythema dose several times over, complete cures have resulted. Gland metastases call for radium implantations and deep x-ray therapy.

4. *Body*.—Surgical operation when advisable is the method of choice in these cases. X-ray is undoubtedly serviceable combined with intra-uterine radiation with radium. We have not seen a cure with x-ray alone. In the inoperable cases, with large gland masses, amelioration of pain and improvement in general health follow judicious x-radiation. The principle advised in treating epitheliomata of the cervix is here applicable. The guiding principles are the maximum treatment to the growth and the minimum to the normal environment.

Adenomyoma.—Adenomyomatous tissue is only moderately radiosensitive; it is, however, possible by implantation with radium to cure some of the inoperable lesions of the rectovaginal septum. It hardly seems likely that adenomyoma can be treated effectually with x-ray beyond the induction of a menopause; it appears from some of our observations that endometriomata do cease to cause disturbance and cease to grow after an x-ray sterilization. When, therefore, operation is contra-indicated or cannot be carried out completely, it is permissible if not obligatory to resort to x-ray treatment.

Tumors of the Ovary.—Tumors of the ovary whenever feasible demand operation. Certain carcinomata, especially in children, as well as some of the round cell and angiosarcomata respond well to x-radiation. A number of successful cases appear in the literature. The ordinary cystadenomata are not radiosensitive. The dosage for a sarcoma localized in the pelvis but inoperable by reason of its fixation should be the same as in carcinoma.

Great interest attaches to the treatment of a papillary carcinoma which has metastasized and become disseminated over the peritoneum and produced ascites. In certain individual instances, x-ray like the radium pack ought to prove of great value. Owing to the widespread character of the trouble, a heavy dosage is contra-indicated; with careful broken doses, a shrinkage not infrequently follows with relief of obstruction and often with a cessation of the ascites.

Pruritus Vulvæ.—X-ray is of great value here when the disease is unassociated with leukoplakia, kraurosis, or an inflammatory eczematous condition and not due to some determinable general cause. There is a well-defined tendency to recurrence.

One ought not to give more than 30 per cent of an erythema dose at a sitting, with a low voltage, and a closed tube technique, to affect the skin principally.

Chronic Pelvic Inflammatory Disease.—In a limited experience, we note some excellent results. The chief complaint is pain, especially at the menstrual period when the recrudescences occur. Pus is usually absent, but the patients are miserable and some relief is imperative. The time-honored rest in bed, hot douches, and general measures are adjuvants. It is evident that x-ray cannot relieve adhesions, but as a matter of experience we find that when menstruation ceases the pain often disappears also, and that partially ineapaci-

tated women are restored to their normal activities. The principle involved seems to be that the cessation of menstruation, by putting the pelvic organs at rest, affords the opportunity for recuperation. When the menopause is near, a full sterilization dose should be given; in younger women, a partial or temporary sterilization should be attained. It is important here to use fractional dosage, say one-tenth of the erythema dose at each sitting, which we find is well borne and apparently without the risk of stirring up the infection. A heavy dosage risks a severe reaction.

Tuberculosis of the Tubes and Ovaries.—Tuberculous infections of the tubes, ovaries, and peritoneum are greatly benefited by x-radiation. While the tubercle bacillus *in vitro* is hard to kill even by very heavy treatments, tuberculous lesions in all parts of the body are favorably influenced by local radiations of a mild character. The x-ray treatment should not be over 20 per cent of the erythema dose and should be given fractionally. In conjunction with the x-ray, ultraviolet light treatment, fresh air, adequate food, and all the other methods applicable in general tuberculosis are invaluable. The effect on ascites and on general health is striking and compares most favorably with operative results.

CHAPTER XLVI

PNEUMOPERITONEAL ROENTGENOGRAPHY—A DIAGNOSTIC AID

REUBEN PETERSON

GENERAL CONSIDERATIONS

CONTRA-INDICATIONS

TECHNIQUE

VALUE

SUMMARY

General Considerations.—Diagnostically, the gynecologist is more fortunate than workers in some other special fields; by abdominovaginal and abdominorectal bimanual examination he can palpate the uterus, its appendages, and the other pelvic contents, normal and abnormal, and by the history and by experience gained in many bimanual examinations he is usually able to make an approximately correct diagnosis. However, there are not a few instances where he is left in doubt concerning the exact status of the pelvic organs. For example, the appendages may be covered by exudate and bound so closely to the pelvic walls that the examining finger slides over but fails to locate them. Neoplasms may be palpable bimanually, but there may remain a doubt as to their relations to the uterus and its appendages.

In a recent study of the relative accuracy of clinical versus pneumoperitoneal pelvic roentgenographic diagnostic methods, it appeared that while old clinical methods are usually satisfactory and superior to roentgenography, the latter method is sometimes best in that it demonstrates lesions unrevealed to the educated finger.

Under such conditions, pneumoperitoneal roentgenography proves a valuable diagnostic aid; a correct picture of the pelvic contents is obtainable, and sight added to touch furnishes the correct diagnosis before an operation. Again, surgery may be avoided, a desideratum in these days of unnecessary operations.

While relatively new, roentgenography following the introduction of gas into the abdomen has advanced to the point where we are able definitely to state what can or cannot be accomplished by its use. Furthermore, let it be clearly understood that this procedure does not supplant other time-honored diagnostic methods. It is simply an additional means of diagnosis; not a routine procedure, but one to be held in reserve in case the diagnosis is in doubt.

Before the gynecologist adds pneumoperitoneal roentgenography to his diagnostic armamentarium, he must associate himself with a skilled roentgenologist

interested in the new work and willing to develop a technique for good films to be interpreted correctly. It is easier to secure good films than to interpret them, but with good team work, especially when the roentgenologist can be present at any subsequent operations and observe *in situ* the structures he has just studied roentgenographically, much can be accomplished impossible to either specialist alone.

Contra-Indications.—While it is an adjuvant in doubtful diagnosis, it must not be thought that even this entire group should be subjected to gas inflation, for gas inflation of the abdominal cavity is contra-indicated in acute inflammation of the pelvis or abdomen; in case of doubt, no gas inflation should be used where there is an elevation of temperature or increased leukocyte count after a bimanual examination. This rule holds whether the gas is introduced through the abdominal wall or through the uterus and tubes.

It is also contra-indicated in those who have a circulation impaired by organic heart disease or where an abdominal pelvic growth plus the gas by pressure on the diaphragm may embarrass the heart.

It is also undesirable in highly neurotic women where even a bimanual examination is badly borne or, often, even impossible or valueless by involuntary contraction of the abdominal muscles. Such patients become panic-stricken and utterly unable to coöperate in securing a good film.

Technique.—The technique of a gas inflation antecedent to roentgenography is easily acquired by the gynecologist accustomed to other more elaborate techniques.

Oxygen, used at first for gas inflation, was abandoned because of its slow absorption, occasioning objectionable discomforts. Carbon dioxide, on the other hand, just as effective, has the advantage of speedy absorption no matter how great the distention, and its discomforts rarely last over a half hour. In the latter case, the films must be taken quickly, or the fluoroscopic examination made rapidly, before the absorption of the gas.

Many inflations have shown that the oxygen or carbon dioxide gas purchased in the ordinary tanks contains no pathogenic bacteria. In fact, antecedent to any experiments with gas inflation, it was found that gas cultured as it issued from needle or cannula showed no growths.

The only essential preparation is the emptying of the lower bowel and the bladder; if this is omitted, the film will be obscured by bowel distention (feces or gas), and the full bladder will greatly interfere with film interpretation. It is not necessary to give morphin or another narcotic beforehand. If a sedative seems imperative, it will be best to forego taking the film.

A simple table is used which can be tilted downward, to free the pelvis of its coils of bowel and show the pelvic structures, Figure 744. The proper inclination of the table at about 20 degrees is shown with the frame and the plate holder. Insufficient inclination fails to show gas in the vesico-uterine pouch and the anterior surface of the uterus is not visible. Too great inclina-

tion restricts the exposure of the posterior culdesac which is then overshadowed by the posterior surface of uterus and the appendages may not appear.

The x-ray apparatus is placed above the sacrum and the ray passed down the long axis of the pelvis perpendicular to the film. An 18-inch square of opaque fabric with a 6-inch circular hole cut from its center is laid on the patient's buttocks to serve as a diaphragm.

The Rubin apparatus for ascertaining the patency of the fallopian tubes may be used to regulate the flow of gas from the tank after the pressure has

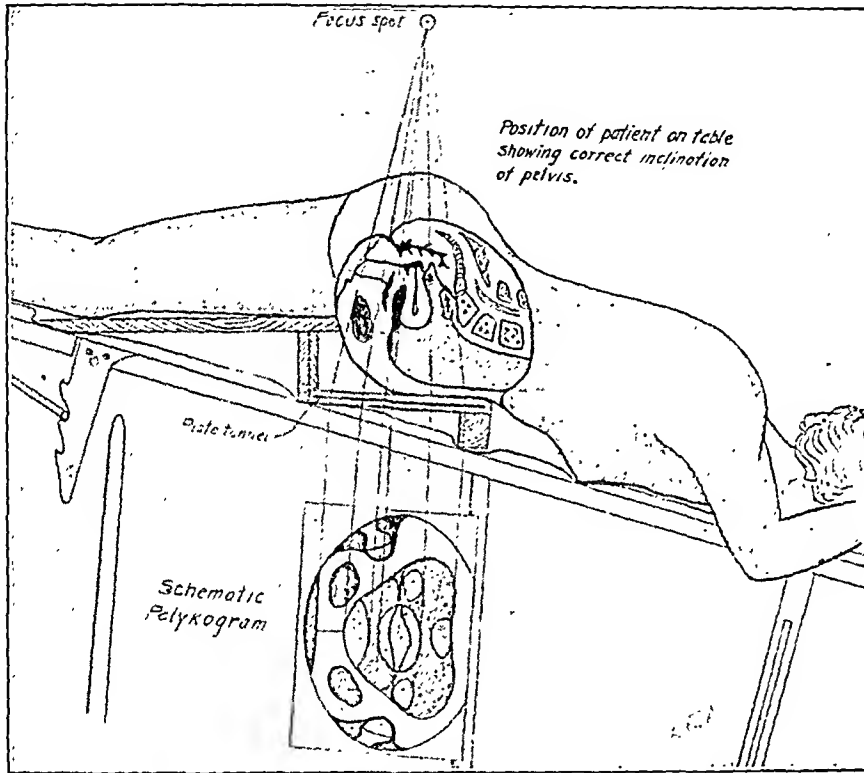


FIG. 744.—CORRECT PNEUMOPERITONEUM OF PELVIC ORGANS AND PROPER POSTURE FOR SKIAGRAM.

been reduced. This both regulates the pressure and measures the amount of gas entering the abdomen and shows under what degree of pressure it enters. Whatever type of apparatus is used, it is essential that the gas should enter under low pressure and that no more than 100 to 150 c.c. should flow in per minute, obviating pain and discomfort.

No matter how slowly the gas is injected, the patient will begin to complain of discomfort after about 400 c.c. have entered the abdomen. As this is hardly enough for a good film, it is necessary to encourage the patient to stand from 800 to 1,000 c.c. While the discomfort is not comparable to the pain and distress of an abdomen distended by 2 liters or more of gas, it is enough to make the diagnostic procedure decidedly unpopular and to limit its use to cases of necessity where the diagnosis is in serious doubt.

The strictest aseptic technique, including sterilization of instruments, preparation of abdominal wall and vagina by iodine, and the use of rubber gloves, is maintained. The gas is passed into the pelvis and abdomen preferably by the transuterine route by Rubin's technique. If the tubes are closed or if there is any purulent or bloody uterine discharge, the transabdominal route must be used. The gloved hand seizes a fold of the abdominal wall and without anesthetizing the skin a lumbar puncture needle is thrust through the skin down to the fascia, then through the latter and the peritoneum. Unless there are bowel adhesions to the abdominal wall, the place of choice for the



FIG. 745.—CHRONIC BILATERAL SALPINGITIS; RIGHT HYDROSALPINX; PATENT LEFT TUBE. (R. S. Cron.)

puncture is in the midline just below the umbilicus. Experience in some hundreds of cases shows that there is no real danger of puncturing an intestine.

When sufficient gas has entered the abdominal or pelvic cavity, the needle or cannula is withdrawn and the patient placed prone on the inclined plane and roentgenograms taken in stereo. She then remains in this position until the carbon dioxide gas is absorbed, usually about a half hour. Assumption of the upright or even horizontal position before the partial absorption of the

gas may cause distress and even vomiting from the pressure on the diaphragm.

Where pregnancy is suspected, the transabdominal route is preferable for the gas inflation. However, in case of an error in diagnosis, the gas being passed by the vaginal route, no great harm results, as often shown when the gas has passed through the uterus and fallopian tubes of a patient, whose pregnancy was demonstrated by subsequent history, without untoward results.

Value.—If there are no pelvic adhesions, the tilting of the pelvis after the pneumoperitoneum will suffice to remove all bowel coils from the pelvis except the rectum and lower sigmoid. If the ray is well directed, optical cross sections of the pelvic organs or new growths within the pelvis will appear on the film. Usually, unless drawn to one side by adhesions or displaced by a neoplasm, the uterus will appear as two cross sections, one of the body and one of the isthmus or supracervical portion. It has been demonstrated that the

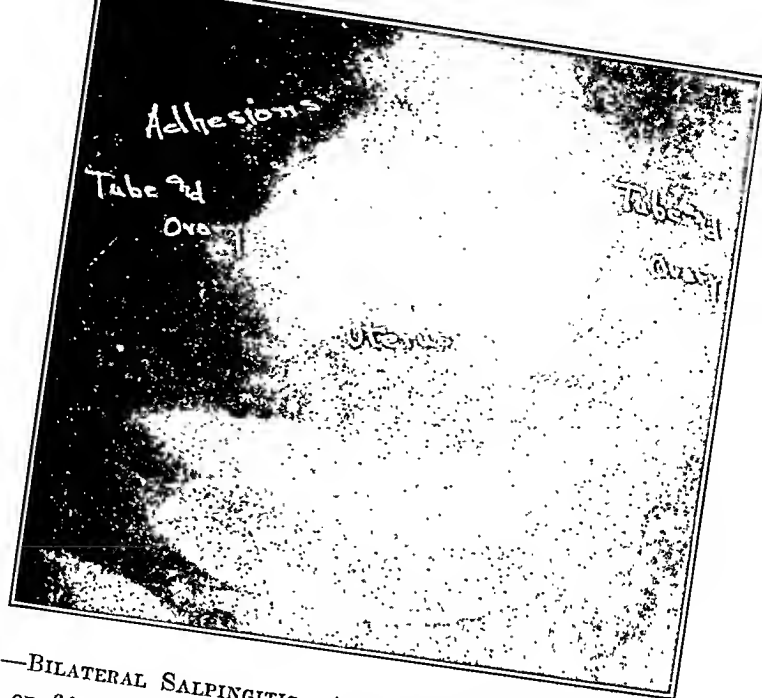


FIG. 746.—BILATERAL SALPINGITIS; ADHESIONS ON LEFT; PATENT TUBES.
 Gas introduced on fifth attempt under pressure of 180 mm. Hg. Bimanual examination revealed only slight left salpingitis. (R. S. Cron.)

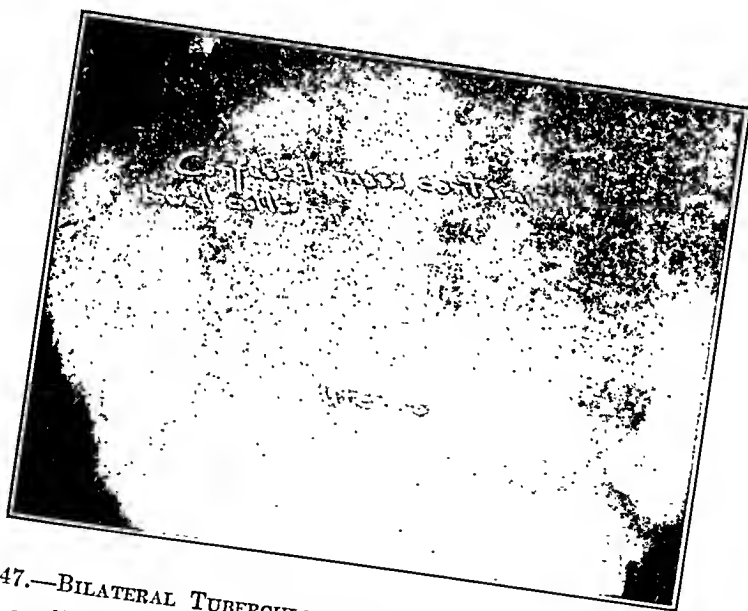


FIG. 747.—BILATERAL TUBERCULOUS SALPINGITIS WITH CLOSED TUBES.
 pathologic condition detected on bimanual examination. Roentgenography revealed
 re pelvic peritonitis. (R. S. Cron.)

latter portion of the uterus, as shown on the film, extends more into the broad ligaments, that is, laterally, early in pregnancy, rendering possible a diagnosis of this condition soon after the first missed period, or as early as the sixth week of gestation—a valuable diagnostic sign early and late in sexual life. In a number of instances young girls with irregular menstrual periods and exposed to pregnancy have been shown nonpregnant by the absence of this enlargement of the isthmus. At the opposite pole of sexual life, also with irregular menstruation, women who have had their families and are apprehensive because of missed periods can be reassured long before the time when signs of pregnancy can be made out by the examining finger or before fetal bones are demonstrable. Again, repeatedly, enlargement of the isthmus has determined the diagnosis of an early pregnancy in a fibroid uterus.



FIG. 748.—BILATERAL TUBO-OVARIAN DISEASE WITH CLOSED TUBES.

Correctly diagnosed by bimanual examination during posterior colpotomy. (R. S. Cron.)

roentgenogram. We often find it easier to demonstrate slight irregularities due usually to fibroids than to be sure of their presence by bimanual examinations. Intramural fibroids often undetectable by the examining finger in a uterus not much enlarged are plainly seen on films.

With the proper inclination of the table and frame, the ovaries and tubes, if nonadherent, drop forward and appear on the films. It is usually perfectly possible to differentiate between an ovary of normal size and one enlarged and adherent. In fact, salpingitis in all stages from slightly enlarged and adherent tubes to larger tubes with pus formation can be made out with but little practice from a study of the stereoscopic pelvic films.

Summary.—1. Bimanual pelvic examination and pelvic pneumoperitoneal roentgenography are supplementary and not antagonistic. Generally a diagnosis sufficiently accurate is made bimanually. Each method has its value, but

nancy can be made out by the examining finger or before fetal bones are demonstrable. Again, repeatedly, enlargement of the isthmus has determined the diagnosis of an early pregnancy in a fibroid uterus.

Varying degrees of bicornuate uterus are well shown by stereoscopic pelvic roentgenograms, thus solving some puzzling cases and revealing what appeared upon bimanual examination to be an appendage, part of a bicornuate uterus.

Uterine irregularities are also easily demonstrated on the stereoscopic pelvic

occasionally where the diagnosis is obscure, pneumoperitoneal pelvic roentgenography is an extremely valuable diagnostic aid.

2. To get the best results, it is essential for the gynecologist to coöperate with a skilled, enthusiastic roentgenologist.

3. It is contra-indicated in the presence of acute abdominal or pelvic inflammation or in patients with impaired circulation or in certain types of highly neurotic women.

4. On account of the rapid absorption of carbon dioxide gas and the equally rapid subsidence of the discomfort due to the inflation, this gas is preferable to oxygen.

5. Excessive quantities of gas cause great pain and discomfort. About 1,000 c.c. of gas are sufficient for good roentgenograms.

6. Under the most favorable conditions it is accompanied by a certain amount of discomfort and even pain; hence it is not a routine method but should be reserved to clarify doubtful diagnoses.

7. With good technique and good judgment in selection of cases, it is without danger, whether the gas is passed by way of the uterus and fallopian tubes or by the transabdominal route.

8. Experience enables the observer to diagnose with great accuracy pathologic changes in the uterus and its appendages.

9. It is possible to discover pregnancy through changes in the isthmus (lower uterine segment) at a much earlier period than by any other direct method.

CHAPTER XLVII

ULTRAVIOLET RADIATION

ROBERT E. FRICKE

Ultraviolet radiation is at present enjoying a notable recrudescence of interest in the treatment of many conditions, but except as a general tonic, little

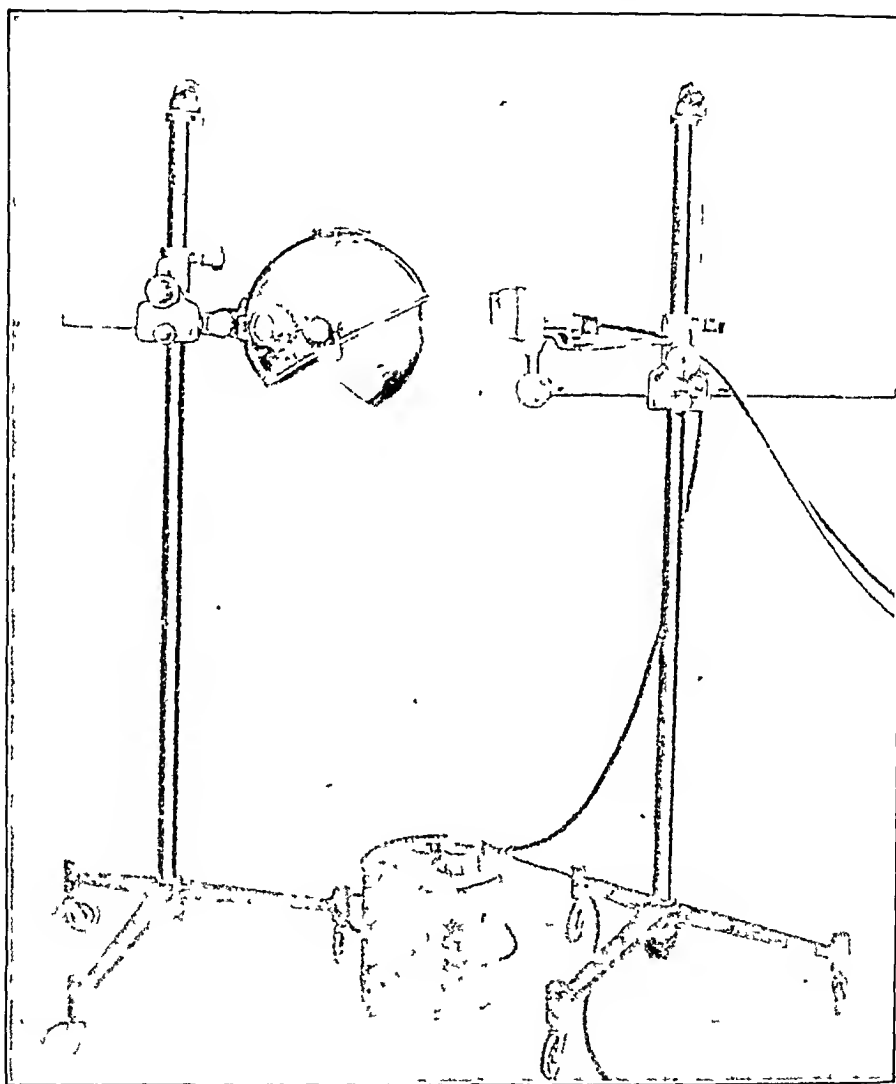


FIG. 749.—TWO TYPES OF MACHINES FOR ULTRAVIOLET THERAPY.

At left is air cooled quartz light apparatus. At right is water-cooled quartz light apparatus, in which quartz rods are fitted.

has been demonstrated concerning its value in gynecology. The ultraviolet rays lie in the spectrum between ordinary light and x-rays. They have a marked dermal effect with but feeble penetration. The therapeutic range is

from 4,000 to 1,800 Angström units; in the laboratory, however, it is possible to produce them as short as 200 Angström units. These rays are found in solar radiation at high altitudes but at sea level are almost completely filtered out by the air. The best apparatus used for their artificial production is the mercury quartz arc, quartz being used since ordinary glass completely absorbs these rays. A notable quantity of the rays is obtainable from the ordinary carbon arc used in electric lighting.

Ultraviolet light seems to activate the body and make possible a greater utilization of calcium and phosphorus. Its use in rickets, tetany, and fractures is based on this, and its value in hay-fever is associated with the same property. Together with liver feeding, rest in bed, and iron, it forms a valuable treatment for the secondary anemias, due to bleeding, in gynecological cases. It is much less valuable than x-ray in treating pruritus vulvæ, but as it is quite harmless, it is always desirable in obstinate cases to give it a chance and one is sometimes agreeably surprised by the result.

The water-cooled applicators which can be used in the vagina or even in the cervix may prove of value in chronic vaginitis and cervicitis—a hope justified by the well-known bactericidal power of the rays.

Overdosage does not entail the serious consequences following an overdose of x-ray or radium, but it does cause an unnecessary, painful, superficial burn which heals in a few weeks. It is, therefore, important that the operator should learn the erythema dose of his own machine before treating patients, and having established this that he should keep within this limit. One must remember that quartz lamps in use gradually vitrify and transmit smaller and smaller amounts of the desirable rays until they are finally as impervious as lead glass. There are a number of convenient apparatuses for measuring the actual amount of ultraviolet light emitted, and in a well-organized laboratory the lamp tubes are frequently tested.

CHAPTER XLVIII

ELECTROTHERMY

GRANT E. WARD

GENERAL CONSIDERATIONS

Currents

Technique

Histology

DISEASES TREATED

Infections

GONORRHEA

Urethritis

Infection of Skene's and Bartholin's Glands

Endocervicitis

Salpingitis

NONSPECIFIC INFECTIOUS DISEASES

Chronic and Cystic Cervicitis

Infected Sinuses and Fistulas

Pruritus

Chancroid; Venereal Warts; Verruca acuminata

New Growths

VULVA, CLITORIS, VAGINA

CERVIX UTERI

Papilloma

Carcinoma

URETHRA

Caruncle, Including Prolapse of Mucosa and Granuloma

Polyps

Carcinoma and Sarcoma

BLADDER

Papilloma, Papillary Carcinoma, and Squamous Cell Carcinoma

Ulcer

Dysmenorrhea

Urinary Tract Treated with Medical Diathermy

Other Operations

GENERAL CONSIDERATIONS

High frequency electric currents are finding a definite place in medical and surgical gynecology, coördinate with a larger field in general surgery. As the matter is new we dwell briefly upon the types of currents used, referring to the literature cited for a more detailed account (G. E. Ward, *J. Am. M. Ass.*, 1925, 84; *Med. J. and Rec.*, 1925, 121).

Currents.—Three types of current are available, the damped monopolar of Oudin, the damped bipolar of d'Arsonval, and the undamped bipolar current from three-electrode vacuum tubes (radio tubes) of the acusector (endotherm knife of G. A. Wyeth) (*Am. J. Electrotherap. & Radiol.*, 1923, 41; *Ann. Surg.*, 1924, 79). Recently apparatuses have been made to yield a cutting current (acusector) without the three-electrode vacuum tubes, by a very finely adjustable spark gap which when almost closed gives a low peak voltage, with oscillations approximating the continuous undamped current from the radio tubes. The rapidity of these oscillations results in one beginning before the

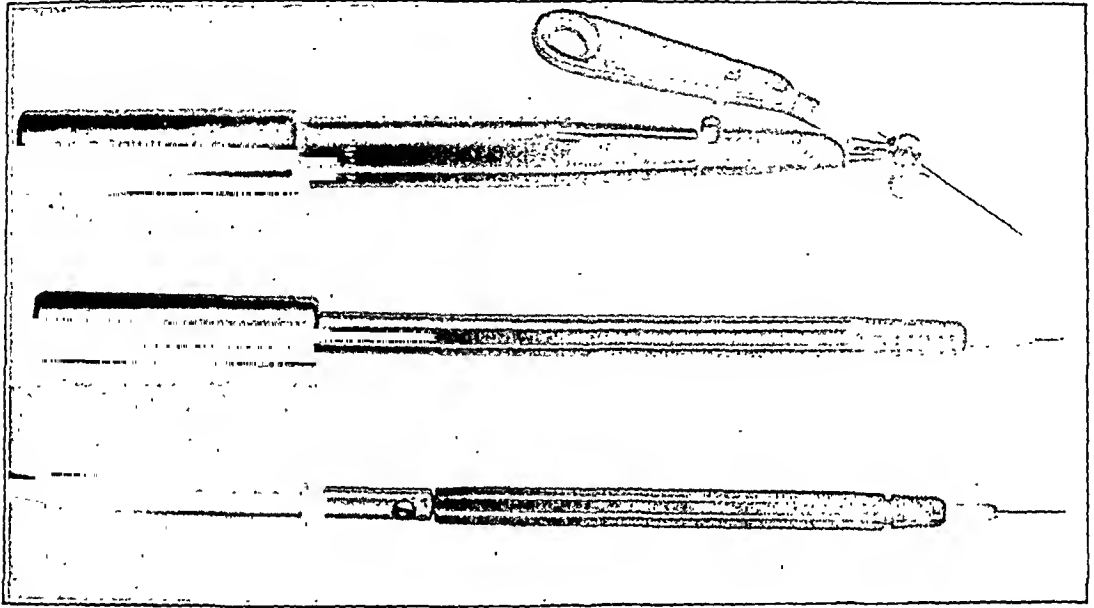


FIG. 750.—THREE TYPES OF ACTIVE ELECTRODES USED IN TREATMENT OF LESIONS OF VULVA, URETHRA, VAGINA, AND CERVIX.

The lowest is shorter and used to make incisions with acusection current. It is fitted with adjustable tip for the interchange of needles. Shield is pulled backward to show method of attaching wire.

preceding oscillation has faded out, so that although the spark gap current is damped, its efficiency for cutting is equal to that of the radio-tube current.

Technique.—Two principal types of active electrodes are in use—the needle, Figure 750 and 751, first described by F. R. Cook (*Med. Rec.*, Dec., 1907, 72), and later extensively used by W. L. Clark and G. A. Wyeth, and the blunt (button, spherical, and olivary) electrode of E. Doyen (*Surgical Therapeutics and Operative Technic*, 1920), B. C. Corbus and V. J. O'Connor (*Diathermy in the Treatment of Genito-Urinary Diseases with Especial Reference to Cancer*, 1925), G. K. Kolischer and H. Katz (*J. Am. M. Ass.*, 1922, 78; *Urol. & Cutan. Rev.*, 1916, 20); and others. We use constantly the sharp needle electrode under accurate control and continually in sight. With this a variation of current is obtainable from the minutest, almost invisible, spark to a lightninglike explosion in massive tumors for rapid destruction. For treat-

ment through cystoscope, proctoscope, or vaginal speculum, various sizes and shapes of needles are used in suitable handles as shown.

The inactive electrode is a flat piece of lead foil, a piece of heavy wire mesh, or sheet copper covered with asbestos and linen, or a heavy piece of felt covered with a perforated malleable metal. The best general size is 8 by 12

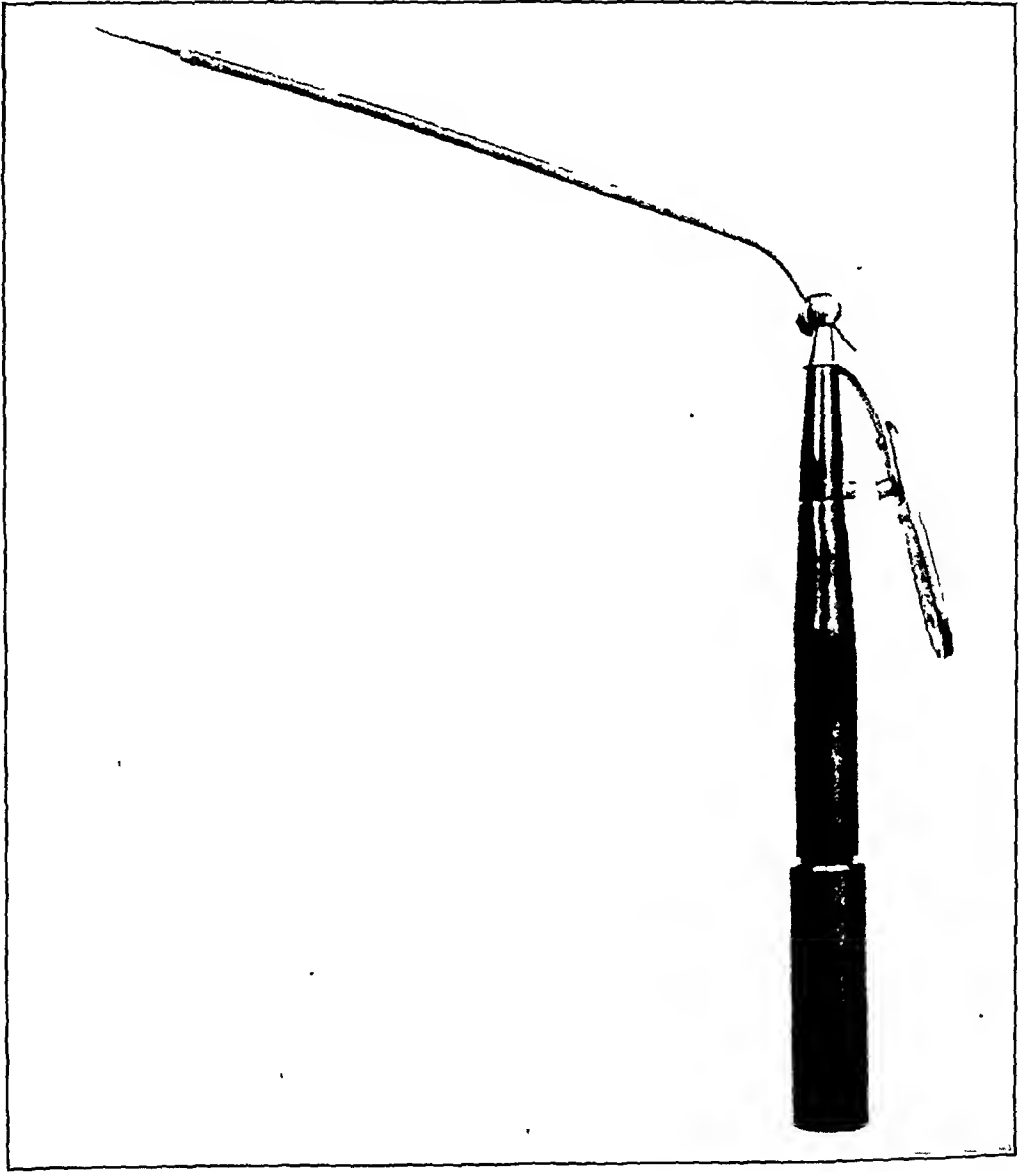


FIG. 751.—ELECTRODE USED IN TREATING TUMORS OF BLADDER THROUGH OPEN-AIR KELLY CYSTOSCOPE.

inches. The pad is thoroughly moistened (plain lead foil is covered with soap suds) and brought into close contact with buttocks or shoulders.

A strict aseptic technique is observed in using the active electrode. The concentrated current sterilizes the adjacent tissues but contamination may come from handles and wires leading to the electrode unless carefully sterilized by boiling or soaking in carbolic acid and alcohol.

The active needle electrode becoming gummed with coagulated débris is best cleansed with a steel or brass wire sponge.

The operative technique may seem simple at first, but the best results call for time and study.

The tissues are desiccated or dehydrated by the monopolar Oudin current in one of two ways: By playing a spark over the surface of the diseased area for a superficial effect, or by plunging the needle in for a deeper destruction



FIG. 752.—INACTIVE ELECTRODE (PAD) BENEATH BUTTOCKS OF PATIENT.

where it is held until the tissues are whitened, when the adjacent areas are treated. The depth of the dehydration penetration depends upon the depth of the insertion of the needle, the strength of current, and the duration of the application.

In using the more rapidly destructive bipolar coagulation current the needle is thrust in at various places until the entire diseased area and a surrounding zone of apparently normal tissue are thoroughly treated. There are three fundamental principles involved:

1. Thoroughness of treatment. All of the disease must be destroyed with the least injury to normal tissue. Care must be taken not to trespass too far into the unaffected tissues as sloughing always extends beyond the visible area

treated. While it is best to finish at a single sitting, it is also possible to treat any areas overlooked on one or more subsequent occasions without fear of causing dense scar tissue as in repeated applications of x-ray or radium.

2. Dry surface. Continued hemorrhage indicates insufficient treatment and remaining vitalized tissues and a probability of recurrence.

3. Circumvallation, a principle advocated particularly by Clark and Wyeth, is an important detail. A zone of coagulation is first thrown around



FIG. 753.—DESICCATING EFFECT OF CURRENT; CELLS DEHYDRATED, ELONGATED WITH SPINDLE-SHAPED NUCLEI, HAVE NOT LOST THEIR OUTLINES.

the growth, and if possible beneath it, cutting off the surrounding blood and lymph channels, when tissue can safely be taken for diagnosis, followed by the coagulation of the entire tumor which is next removed as a sterile piece of dead tissue.

Under this current a white coagulum is formed by the tissues as the fluids boil up and leave a tough dry mummified mass. A continued application of the current carbonizing the tissue should be avoided as it prevents the penetration of both current and heat (Wm. L. Clark, *J. Am. M. Ass.*, 1914, 63; Wm. L. Clark, J. D. Morgan, and E. J. Asins, *Radiology*, 1924, 2). Powerful

bipolar coagulating currents must be used with great care in the neighborhood of large vessels. The slightest touch of a large vein or artery by the needle instantly damages its wall with immediate or subsequent dangers. To guard against secondary hemorrhage the patient must be watched and the wound kept sterile with a hypochlorite solution to keep the slough hard and adherent until well separated, when the vessels will be thrombosed. Immediately after thorough desiccation or coagulation the dead tumor may be removed with a curet,

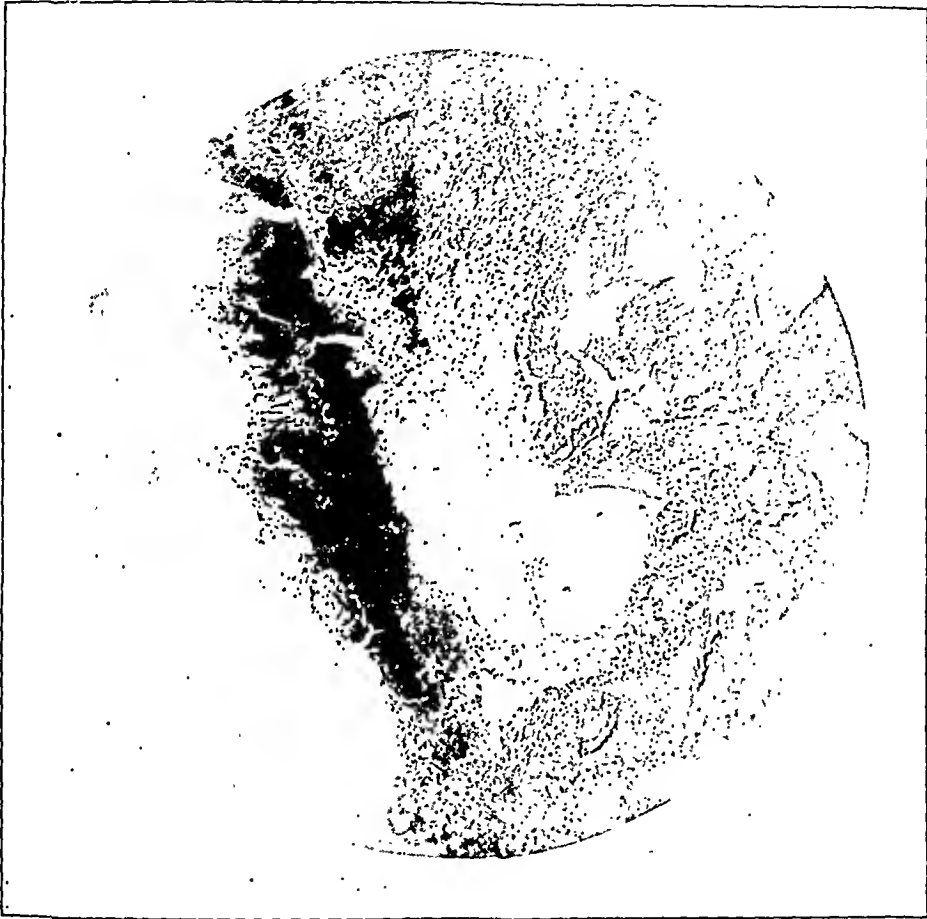


FIG. 754.—COAGULATION OF TUMOR CELLS INTO HOMOGENEOUS, GRANULAR MASS BY HEAVY BIPOLAR CURRENT.

scalpel, or scissors, but preferably, in most instances, with the acusector, requiring no exchange of instrument and hastening the procedure. The liability to secondary infection is lessened by the sterilization of all infected areas by the intense heat, by handling entirely with forceps, and by using few or no ligatures or sutures—appropriately designated a “knife and fork operation.” Electrothermic operations are remarkably free from pain, as the nerve ends are destroyed and the new scar tissue is pliable and soft, avoiding constriction of the new nerve terminals.

The acusector is a powerful instrument in skilled hands, not to be taken

up carelessly. A new surgical touch is necessary, quite different from the "pressure touch" of the skilled hand which has for ages wielded the scalpel. For perfect cutting with the radio-tube current there must be a slight arc between the tip of the needle and the tissue—pressure obliterating this arc is a common fault.

It is best to clamp larger vessels before cutting and ligating.

In the medical use of high frequency currents (medical diathermy) there is no tissue destruction, while the temperatures in the tissues are raised sufficiently to increase the blood supply, relax muscles, relieve pain, and in some instances to destroy infecting organisms, notably the gonococcus. The heat is

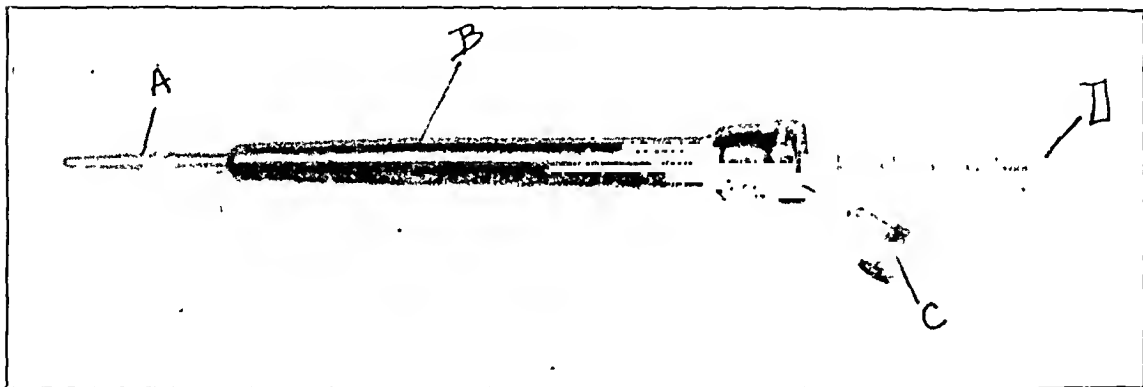


FIG. 755.—CORBUS THERMOPHORE CONSISTS OF THIN NICKEL-PLATED SHELL (A) CLOSED AT ONE END, MEASURING 5 MILLIMETERS IN DIAMETER; A HARD RUBBER SHIELD (B) MEASURING 15 CENTIMETERS BY 1 CENTIMETER, IS ATTACHED, ALLOWING AN EXTENSION OF 4 CENTIMETERS FOR INSERTION IN UTERUS; AN INSULATED TERMINAL (C) FOR ATTACHMENT OF CABLE, SUPPLYING CURRENT; THERMOMETER (D) INSERTED TO FULL DEPTH OF SHELL AND READINGS TAKEN FROM EXPOSED PORTION.

The greatest accuracy is necessary in constructing instrument to insure its proper performance. Any small diathermy machine capable of supplying 800 to 1,000 milliamperes will produce heat enough to apply thermophore. (Corbus and O'Connor.)

developed at a point within the body by the passage of high frequency currents between large electrodes placed on opposite sides, avoiding temperatures lethal to the body cells. A similar effect is secured with a smaller "active" electrode placed in a cavity (cervix or urethra) concentrating the current in the adjacent tissues. The temperature must not be high enough to destroy the surrounding tissues, determined by the careful regulation of the current and the measurement of the temperature of the tissues.

Surgical diathermy by contrast, as first shown, destroys the tissues by the concentration of the current in a small electrode-needle or small disk, the great increase in the amount of current flowing through the small area covered by the needle or disk raising the temperature far above the lethal for human cells. Doyen reports 500° C.—600° C. working with beef; Ward and West found that a current of 700 milliamperes for one minute of time caused a rise in temperature to 70°–80° C. at a distance of 1 centimeter from the needle (unpublished).

The action of medical diathermy is not wholly clear for while many clinical facts reported support the dictum that high frequency currents passing through the body between the electrodes do raise the temperature deep within the tissues, the experiments of C. F. Bowman (*J. Radiol.*, 1925, 6) seem to show that this is only true in a homogeneous medium and that in the body,

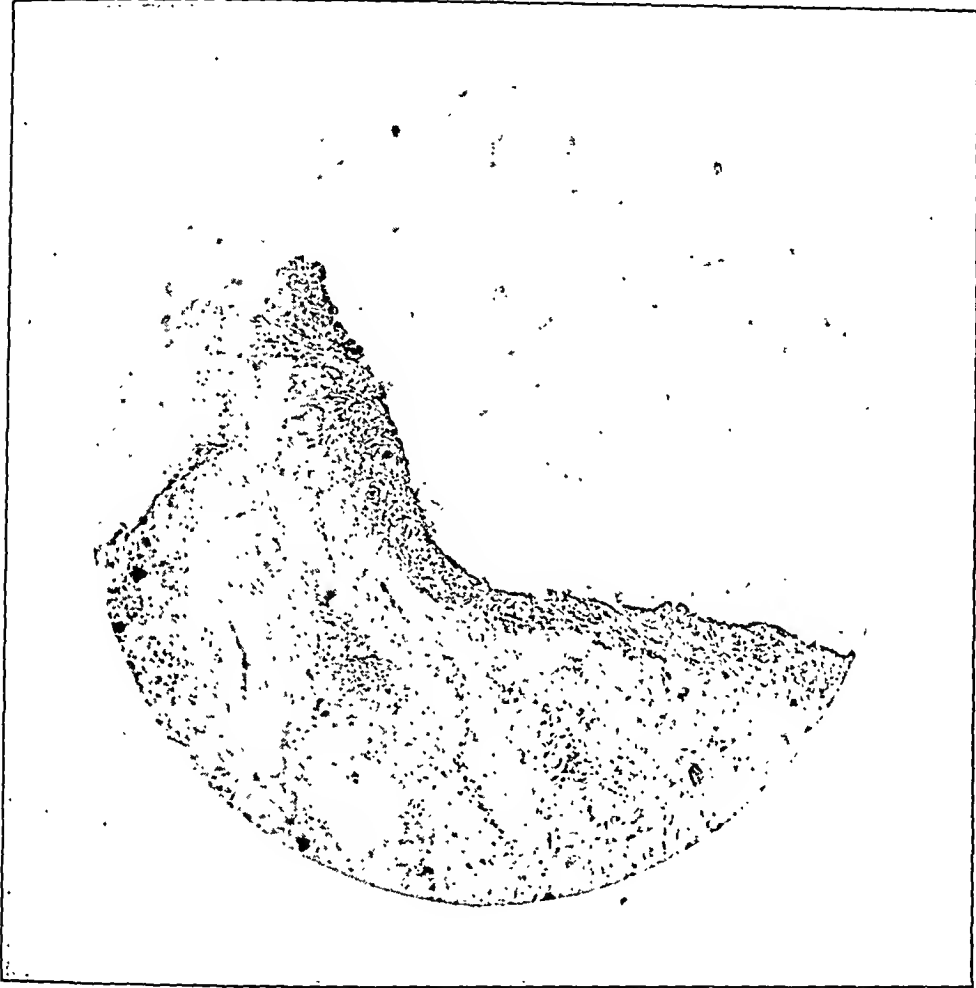


FIG. 756.—EFFECT OF ACUSECTION (ENDOTHERM KNIFE) CURRENT.

Note thin line of carbonization at edge, with wider zone of desiccation and coagulation beneath. Depth of these two zones is 0.1 millimeter.

with tissues varying widely in their electrical conductivity—bone, connective tissue, blood-vessels, muscles—it is impossible to raise the temperature of deep-seated organs to any marked degree.

Histology.—Desiccation (monopolar current) dehydrates and reduces the tissues to a dry whitish material, under the microscope, furnishing elongated and spindle-shaped cells with drawn-out nuclei, Figure 753. The bipolar current coagulates the cell proteins into a homogeneous mass, the connective-tissue stroma being converted into an eosin-staining hyaline material and the blood-

vessels being filled with clotted blood, often with walls destroyed and included in the structureless mass, Figure 754.

The current of the acusector cuts by molecular disintegration due to the bombardment of the molecules by the equal oscillations of the undamped current and breaks them down into their ultimate constituents, forming on the edge of the incision fine particles of carbon in a slightly brownish coat, under the microscope constituting a tiny black line along the cut edge, backed by a thin layer of coagulation, Figure 756. Both these layers measure but 0.1 millimeter in thickness, not enough to prevent primary union.

DISEASES TREATED

Infections.—*Gonorrhea.*—In view of the high susceptibility of the gonococcus to heat and the enhanced permeability of this agent as compared with

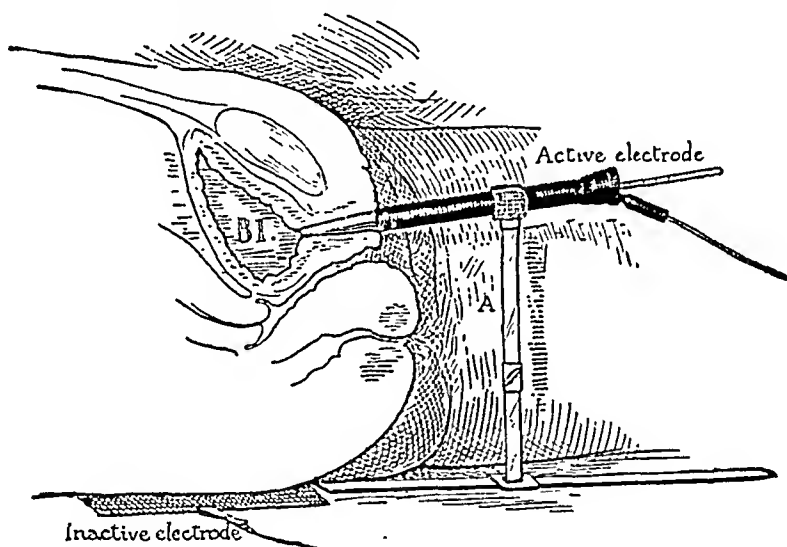


FIG. 757.—THERMOPHORE IN TREATMENT OF DISEASES OF FEMALE URETHRA.

Inactive electrode may be placed beneath buttocks or over suprapubic region; mesh belt is preferable. (Corbus and O'Connor.)

chemicals, it would seem to be the means *par excellence* for destroying these organisms. In this connection it will be of interest to recall the "spontaneous cures" which occur in males when an epididymitis or prostatitis has been accompanied for a number of hours by a temperature of 102°–103° F. Gonococci frequently disappear permanently from the urethra during respiratory infections, and the same observation has been made during the pyrexia of typhoid. The gonococcus is instantly destroyed at a temperature of 113° F. (45° C.) or at 104° F. (40° C.) prolonged for six to eight hours. B. C. Corbus has had a wide and favorable experience in treating gonorrhea with high frequency currents in both male and female.

His thermophore, Figure 755, admirably supplies a regulated heat within the tissues of the urethra and cervix under accurate control. A thermometer

furnishes readings to be taken from time to time. The thermophore itself is the active electrode while an inactive one is placed as a band around the buttocks and the pelvis.

Urethritis.—The thermophore is inserted into the urethra and held in place by a clamp, Figure 757. If no pain or tingling occurs at a tempera-

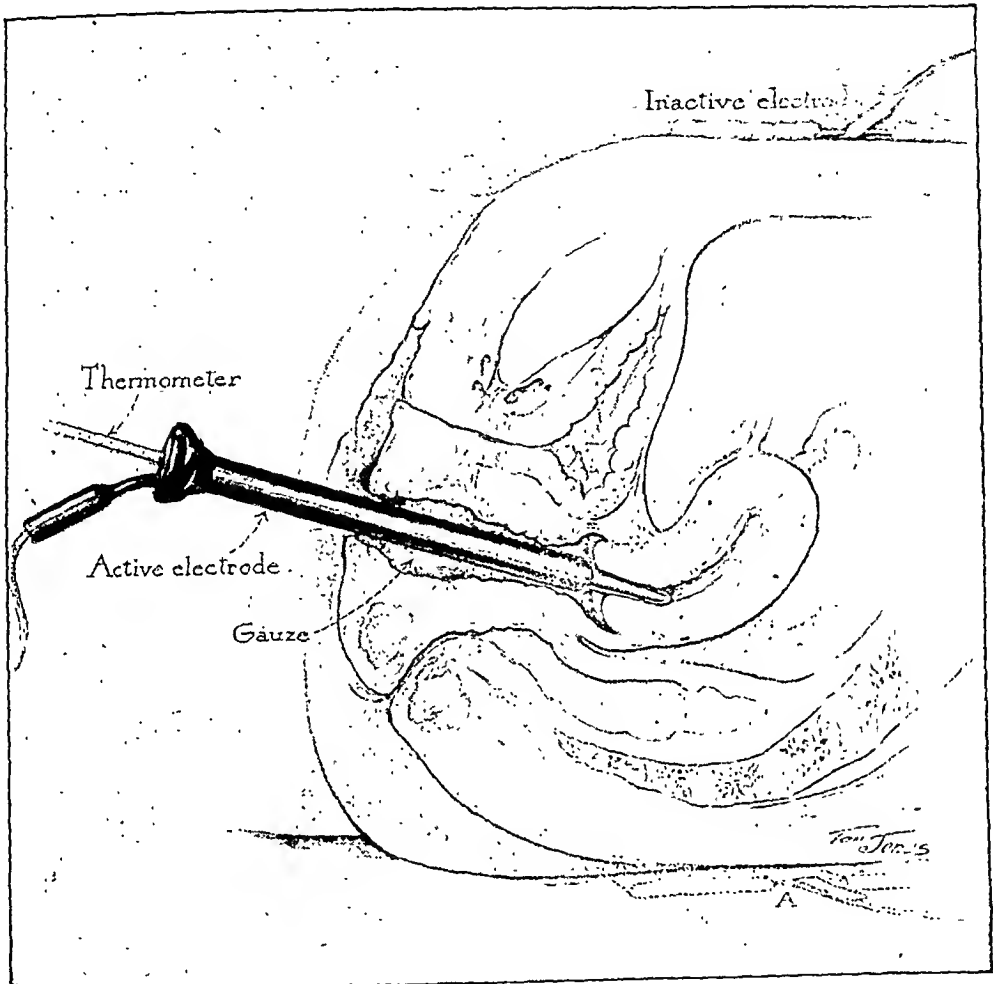


FIG. 758.—APPLICATION OF DIATHERMY IN GONORRHEAL ENDOCERVICITIS.

Inactive electrode may be placed alternately just back of symphysis pubis or beneath sacrum. Large mesh belt preferable. Cervical thermophore is active electrode. Smaller active electrode localizes heat directly around it. Thermometer registers approximate degree of heat in tissues immediately surrounding electrode. (Corbus and O'Connor.)

ture of 112° – 113° F. (44.5° C.– 45° C.) the application should be continued for thirty minutes, when the current is gradually decreased over a period of two to three minutes.

The sedative effect is gratifying; on an average the gonococcus disappears from the urethra after one or two applications. Three treatments are usually sufficient. After diathermy treatment a para-urethral infection is much less likely, occurring in but one of forty-one treated by Corbus and O'Connor.

Infection of Skene's and Bartholin's Glands.—A fine needle used as the active electrode is inserted into the gland and a weak current turned on and continued until the surrounding tissues are whitened and dried. If the infection is more extensive and the gland enlarged the needle point should be moved about to form contacts with the involved tissues. We have used this satisfactorily also in nonspecific infections.

If the glands are swollen and contain pus make a free incision under local anesthesia and evacuate the gland and destroy the interior with desiccation.

Endocervicitis.—The inactive electrode is adjusted as in urethral treatments with the cervix well exposed and the metal end of the thermophore inserted into the canal up to the hard rubber sheath and held there, Figure 758. A mild current is turned on and gradually increased until the thermometer registers 116° – 117° F. (46.5° – 47° C.) at which point it is stabilized and continued for thirty to forty minutes. This type of treatment is useful in acutely inflamed as well as in chronic gonorrheal cervixes.

The treatments are continued until the gonococcus is absent in five successive smears after which the patient returns twice a month for observation, one being made forty-eight hours after cessation of the menses. If no gonococci are discoverable during the first two months, an endocervical application of 5 per cent silver nitrate solution is made and smears taken twice during the week following; if these are negative the patient is declared well. Such a method is contra-indicated in pregnancy, or in the presence of suppurative pelvic inflammatory changes (Corbus and O'Connor).

Salpingitis.—Medical diathermy is here used as an adjunct to the usual methods of treatment. The customary medical procedures are carried out with the addition of a through and through diathermic treatment. The flat electrodes, 6 by 6 inches, are used, one over the suprapubic area and one over the sacrum. The first treatment is given for forty minutes using a maximum of 750 milliamperes. The effect should be promptly and distinctly beneficial. Any increase in pelvic pain or an immediate elevation of more than one degree of temperature contra-indicates further diathermy for a time. If the tubes drain through the cervix the results ought to be uniformly favorable. Acute inflammations of the uterine adnexa contra-indicate intracervical or intra-uterine treatments (Corbus and O'Connor).

Corbus and O'Connor continue: "Chronic salpingitis gives uniformly good results when treated by diathermy alone. Increased vascularity and free drainage undoubtedly account for these results rather than the direct bactericidal effect . . . in a series of thirty-five tabulated cases we have obtained complete relief without resorting to surgical measures in a single instance. In these cases through and through diathermy is alternated with endocervical applications."

Nonspecific Infectious Diseases.—**Chronic and Cystic Cervicitis.**—This can be treated by bipolar electrothermy, the active needle elec-

trode being thrust into the cervix at various points until the diseased area is thoroughly coagulated. The dead tissue can then be curetted away or removed by acusector or scissors and the base desiccated to stop any oozing, or it may be left to be thrown off. We believe, however, that cauterization with a hot copper cautery is less likely to be followed by hemorrhage.

Infected Sinuses and Fistulas.—When located about the cervix or rectum, these are obliterated by the electric current, a long sharp electrode sterilizing the infection and promoting the growth of healthy granulations to fill the defect. In treating *fistula in ano* the whole tract is first laid open with the acusector for thorough drainage, and the monopolar, or, if the disease is extensive, the bipolar current applied to sterilize.

Pruritus.—After excluding constitutional causes, one uses a spark, governed by the extent of the disease in the depths of the tissue. The active pointed monopolar electrode is played over the surface until it presents a white desiccated appearance. If the disease is deep-seated, the needle should touch or slightly penetrate the skin; the duration of application is shortened by using a flat disk as an active electrode and treating larger areas at a time with the instrument in contact with the skin.

The after care consists in daily applications of an antiseptic salve, such as a 1 per cent yellow oxid of mercury or *mercurochrome* ointment, until the desiccated tissue becomes detached and replaced by normal epithelium.

Chancroid; Venereal Warts; Verruca acuminata.—Venereal warts and small benign genital tumors are destroyed quickly and effectively by the desiccating current, with little if any scarring. There are several good ways of treating small growths. The direct method is to apply the monopolar current and keep it in contact until the tumor is white from the dehydration. By the indirect method the patient grasps a tubular electrode or lies on a pad, while the operator touches the diseased area with a needle, the current passing from the patient through the wart to the needle with the operator acting as a condenser; with the concentration of the current in needle and wart, all the destruction goes on in the tumor.

New Growths.—*Vulva, Clitoris, and Vagina.*—Benign tumors yield quickly to desiccation or coagulation with a resultant soft pliable scar. Fibromata, lipomata, papillomata, warts, and moles are easily eliminated with a monopolar current; if the growth is large, the bipolar is necessary. The direct or indirect method as described may be used with local anesthesia.

Sinclair Tausey (*J. Am. M. Ass.*, 1926, 86) describes the removal of small skin tumors without anesthesia and without pain; if the tumor is pedunculate, clamp it lightly at or near its base and apply the active electrode to its distal portion when the current (mono- or bi-polar) traverses the insensitive growth. A curved pair of forceps (Tausey baffle) is so placed on flat tumors that the growth rests between its jaws, while the active electrode is applied at the center.



FIG. 759.—CARCINOMA OF VULVA BEFORE TREATMENT.

No palpable glandular enlargement.
(George A. Wyeth.)

douches to control infection. A hypochlorite solution is an aid in dissolving the slough though often irritating; yellow oxid of mercury, 1 or 2 per cent, or mercurochrome ointment, 2 per cent, suffices to keep the wound clean.

In treating malignancy it is often well to combine radium with high frequency currents, in more massive tumors implanting emanation seeds and applying the current a few days later. This insures a higher percentage of cures. A stronger radium treatment is in order as the electrothermic operation prevents the painful, sclerotic, slowly healing scar following heavier radiations. The glandular areas draining the disease should also receive heavy prophylactic applications of radium or x-ray.

Clark and Wyeth believe that the ray

With a bipolar current the forceps in the operator's hand completes the circuit; the monopolar current is grounded by the forceps through the operator.

In destroying sarcoma or a carcinoma, Figures 759 and 760, one must use a heavy desiccation or coagulation current with the patient under general anesthesia or sacral block. The tumor is circumvallated and undermined if possible with a wall of coagulation, then treated directly with the strong current and the dead tissue removed with curet or acusector and the base desiccated to assure thoroughness and dryness. Sterile dressings are applied during convalescence. In vaginal tumors, use

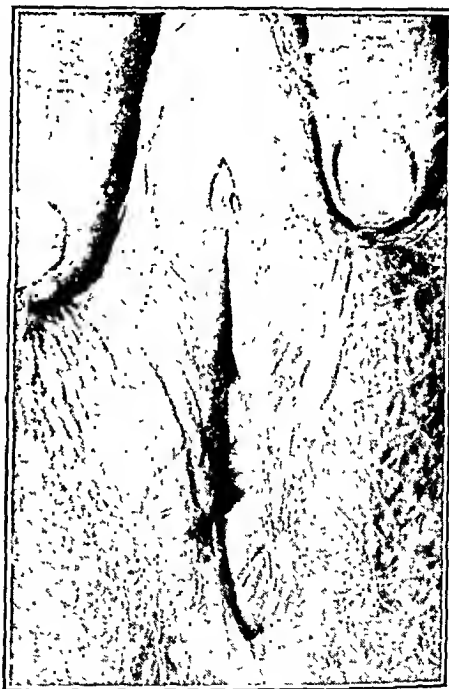


FIG. 760.—SAME AS FIGURE 759 AFTER TREATMENT WITH ELECTRODESICCATION (MONOPOLAR ENDOTHERMY) UNDER GENERAL ANESTHESIA.

Patient catheterized for three or four days following operation to prevent infection and kept in bed several more days to be cleansed by a nurse after each urination.

therapy should be limited to glandular areas, as the local lesions heal more slowly when so treated. Our own experience is that the delay is but slight and not detrimental. We have seen heavy radiation followed in a few days by electrocoagulation ready for a plastic operation in a reasonable time after the eradication. B. F. Schreiner (*Arch. Clin. Cancer Res.*, 1925, 1) con-

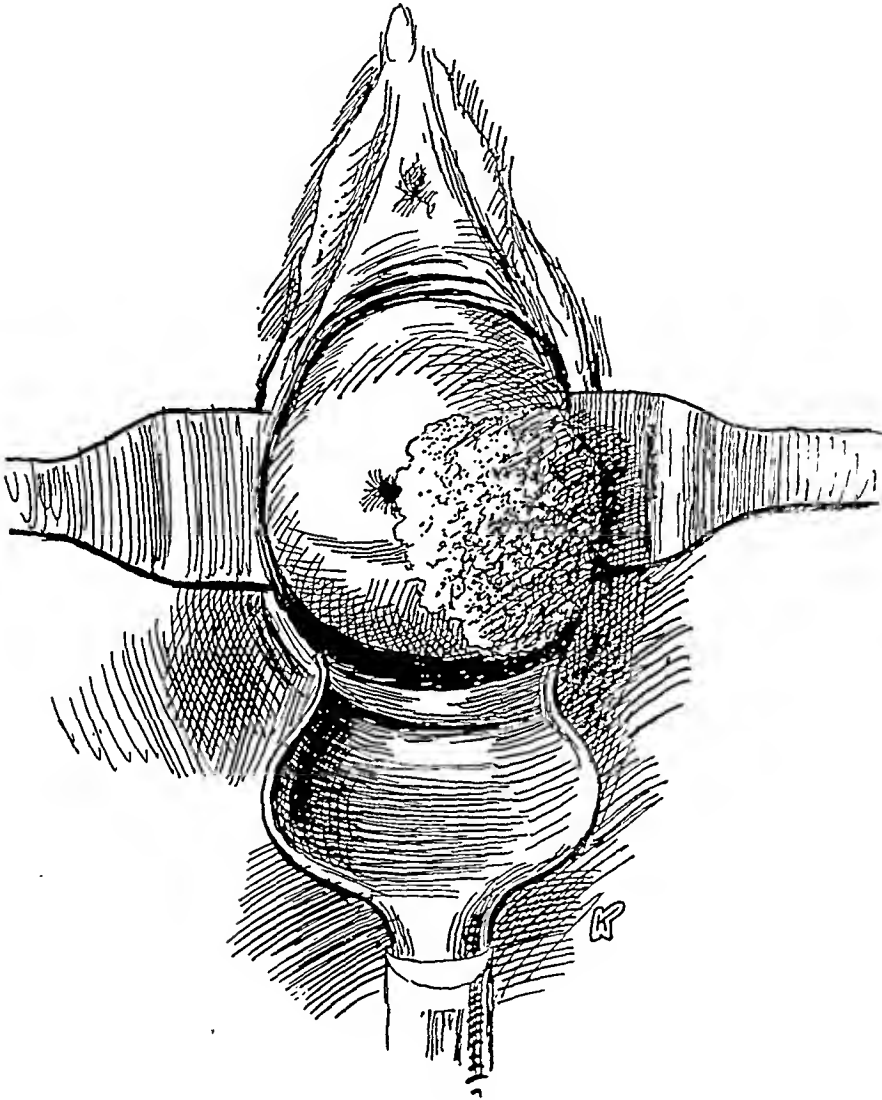


FIG. 761.—CARCINOMA OF CERVIX UTERI.

cluding a discussion of thirty-one vulvar carcinomata treated by the three methods in combination, says, "The combination of implantation of the primary lesion with seeds and at times seed implantations in the metastases, with high voltage x-rays in addition, followed by electrocoagulation, is the method of choice for the comfort of the patient, as well as for the end results."

Cysts are readily treated by incision with the acusector, evacuation of the contents, a thorough desiccation of the epithelial lining, and drainage.

Cervix Uteri.—*Papilloma.*—The vagina is well-protected by retracting

the walls or by using a cylindrical glass or hard rubber speculum, when the tumor is grasped with a polyp forceps which in turn is touched with the active electrode carrying a coagulating current following the principle of G. E. Ward's technique for hemostasis without suture. The current is continued until the

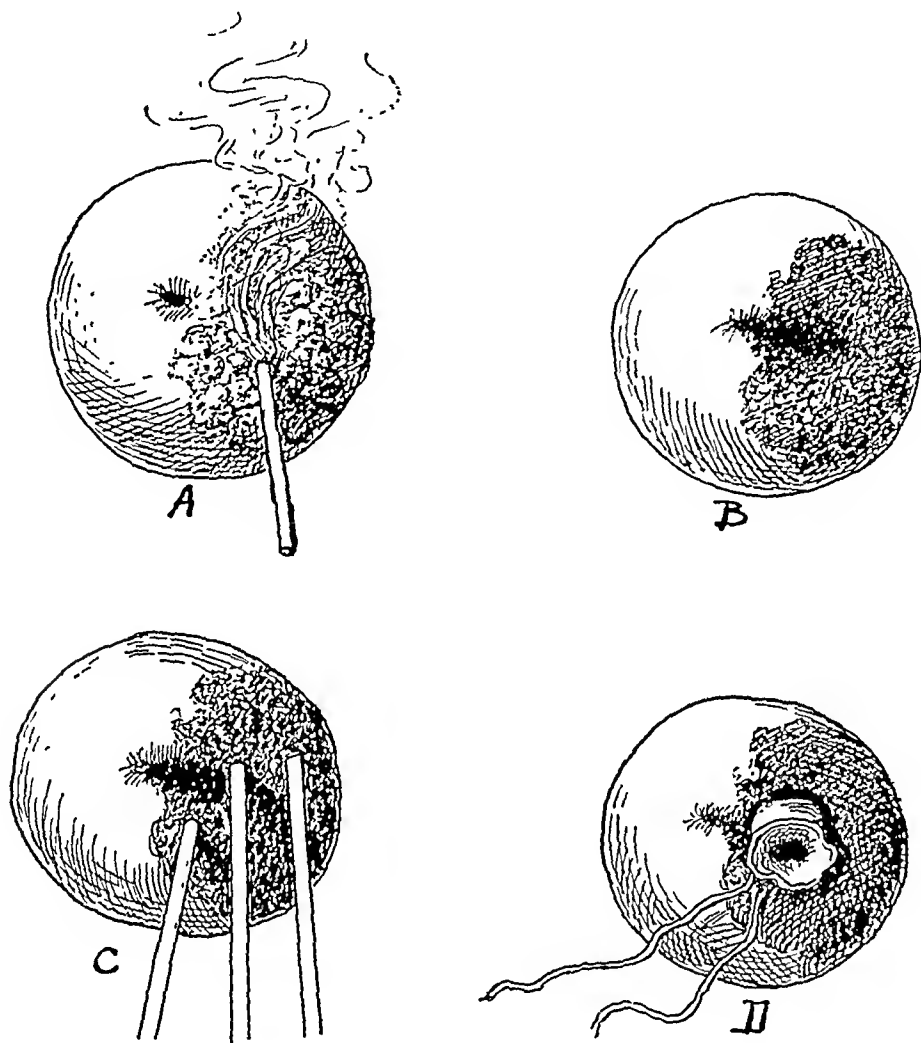


FIG. 762.—A. ELECTRODE IN PLACE COAGULATING CARCINOMA OF CERVIX.

B. INVOLVED AREA AFTER COAGULATION.

C. IMPLANTATION OF RADIUM NEEDLES ABOVE COAGULATED AREA.

D. TUBE OF RADIUM EMANATION INSERTED INTO CAVITY, REMAINING AFTER COAGULATED TISSUE HAS BEEN REMOVED.

pedicle is coagulated, after which the polyp may be left to drop off or is removed with the acusector, leaving a dry white surface.

If the polyp is sessile, a tonsil snare is used with advantage as the active electrode, removing the tumor as in Clark's method of treating papillary bladder tumors.

Carcinoma.—Here radium is the chief curative agent. Sometimes, however, electrocoagulation is an excellent adjunct, especially when a large cauliflower growth fills the vagina, beautifully removing the massive excrescence

and leaving a flat or concave surface for the radium. In intracervical disease, or when it is early and on the surface, it is a satisfaction to remove most of it and then to radiate in the cavity, Figures 761 and 762.

Urethra.—*Caruncle, Including Prolapse of Mucosa and Granuloma.*—The first rare and the latter rather common maladies are best treated by the monopolar high frequency current applied either with a fine or a blunt electrode; our preference is for the former under local anesthesia, giving the treatment in the office. There is little dysuria or discomfort while healing and the scar is not appreciable.

In prolapse of the urethral meatus Corbus uses a flat electrode 3 by 2 millimeters in contact with the mucous membrane, making the application radially in three to four equidistant areas. As the wound heals the prolapse shrinks, and the meatus assumes a normal appearance.

Polyps.—Polyps at the external meatus are removable by using a clamp as the active electrode.

Carcinoma and Sarcoma.—These are best handled by combining radium (implantation or topical application) with the current. The disease, usually at the urethral orifice extending backward, is accessible and amenable to radium, while the current should be used to destroy the exuberant sloughing area, Figure 763.

Bladder.—Electrothermic methods in gynecology here find one of their most interesting and often brilliant fields. There are two methods of approach. The most usual is through the open-air cystoscope with the patient in the knee-chest posture, using a hard rubber speculum as an aid to insulation, especially with the monopolar current which is easily short-circuited.

Experiments of Corbus and O'Connor have demonstrated that bladder tumors can be thoroughly coagulated without serious injury to the bladder wall. Tumors involving the ureteral orifices can be devitalized by coagulation with needle or blunt electrode leaving a normal functioning orifice. Figure 764.

Papilloma, Papillary Carcinoma, and Squamous Cell Carcinoma.—Small papillomata are satisfactorily and quickly treated through the cystoscope with the desiccating current, while larger growths call for bipolar coagulation, Figure 765. A growth 1 centimeter or

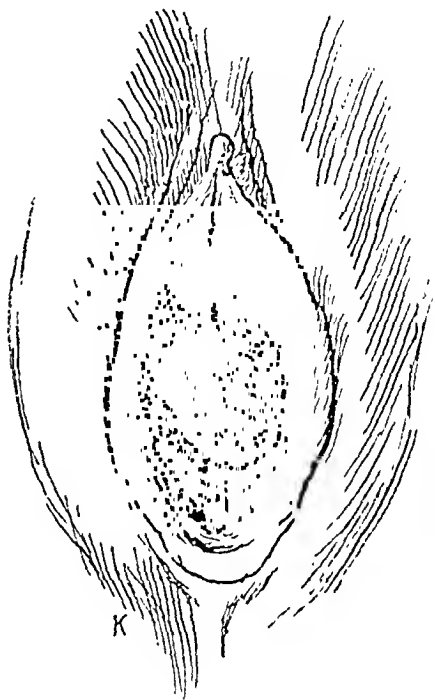


FIG. 763.—SARCOMA OF URETHRAL ORIFICE.

Treated by implantation of radium emanation and removed a few days later with electrocoagulation. Soft pliable scar resulted.

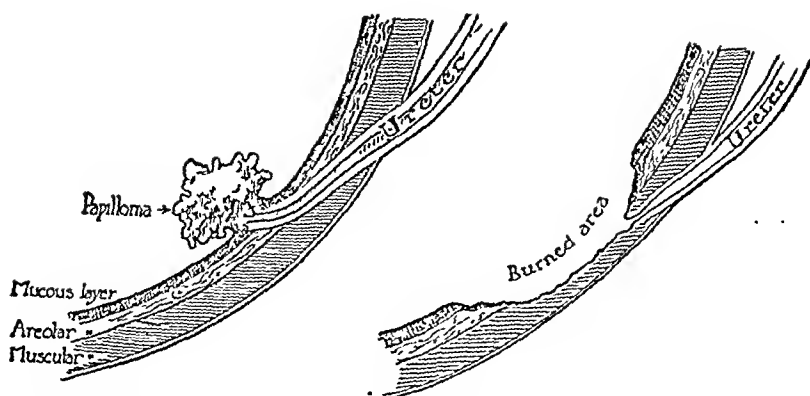


FIG. 764.—DIAGRAM SHOWING, ON LEFT, URETER PASSING THROUGH BLADDER WALL, WITH OSTIUM OBSTRUCTED BY PAPILOMA. ON RIGHT, URETER IS "BURNED BACK" BY DIATHERMY, INCLUDING REMOVAL OF PAPILOMA. (Corbus and O'Connor.)

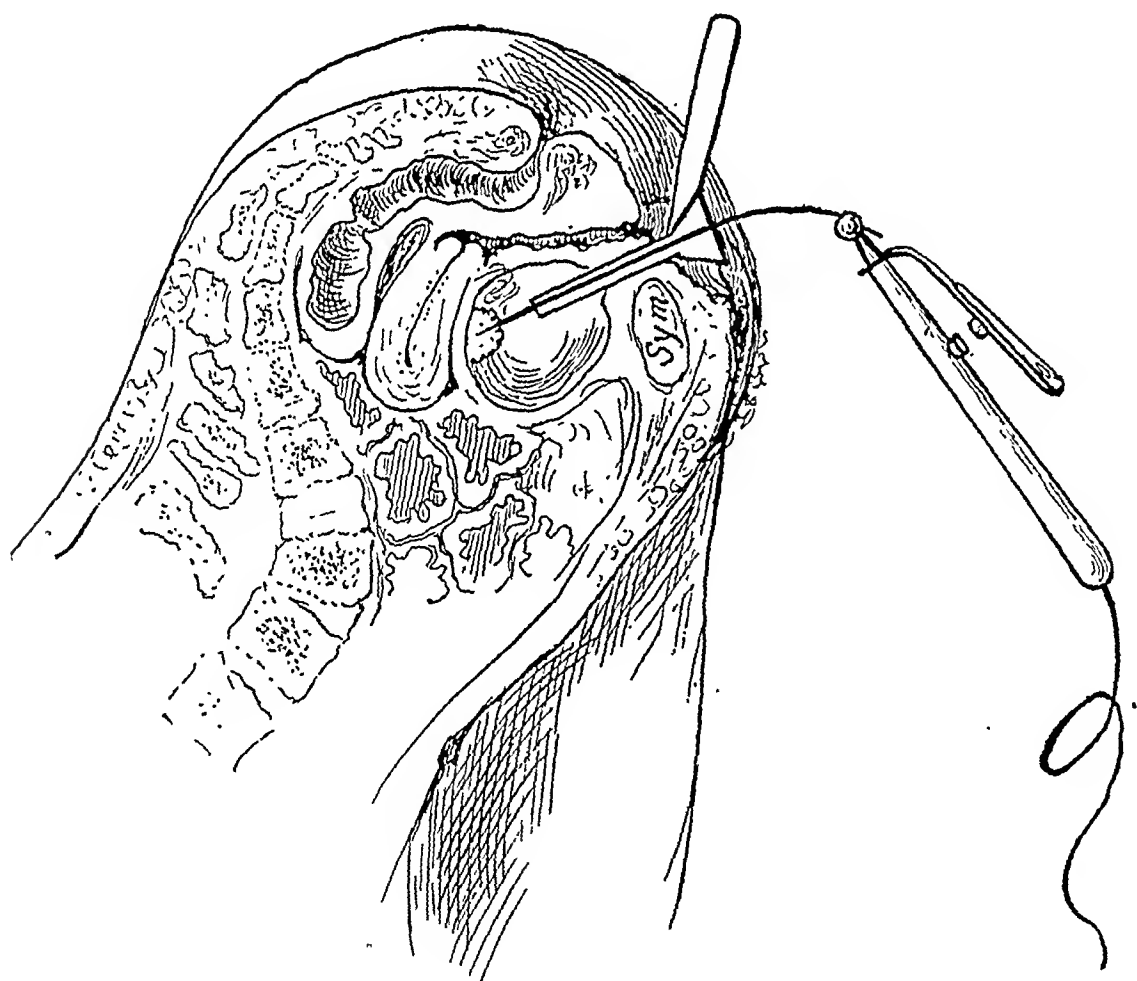


FIG. 765.—TREATMENT OF BLADDER PAPILOMA THROUGH HARD RUBBER OPEN-AIR KELLY CYSTOSCOPE, USING MONOPOLAR OR BIPOLAR CURRENT.

With latter, inactive electrode is strapped around pelvis.

more in diameter is first circumvallated with a line of coagulation and then treated centrally and the dead tissue curetted or left *in situ*. It is interesting, when the papilloma hangs from the base of the bladder or from a lateral wall, to drive the current through the pedicle, desiccating or coagulating it, and so cutting off all nutritive blood supply and causing it to drop off in a few days.

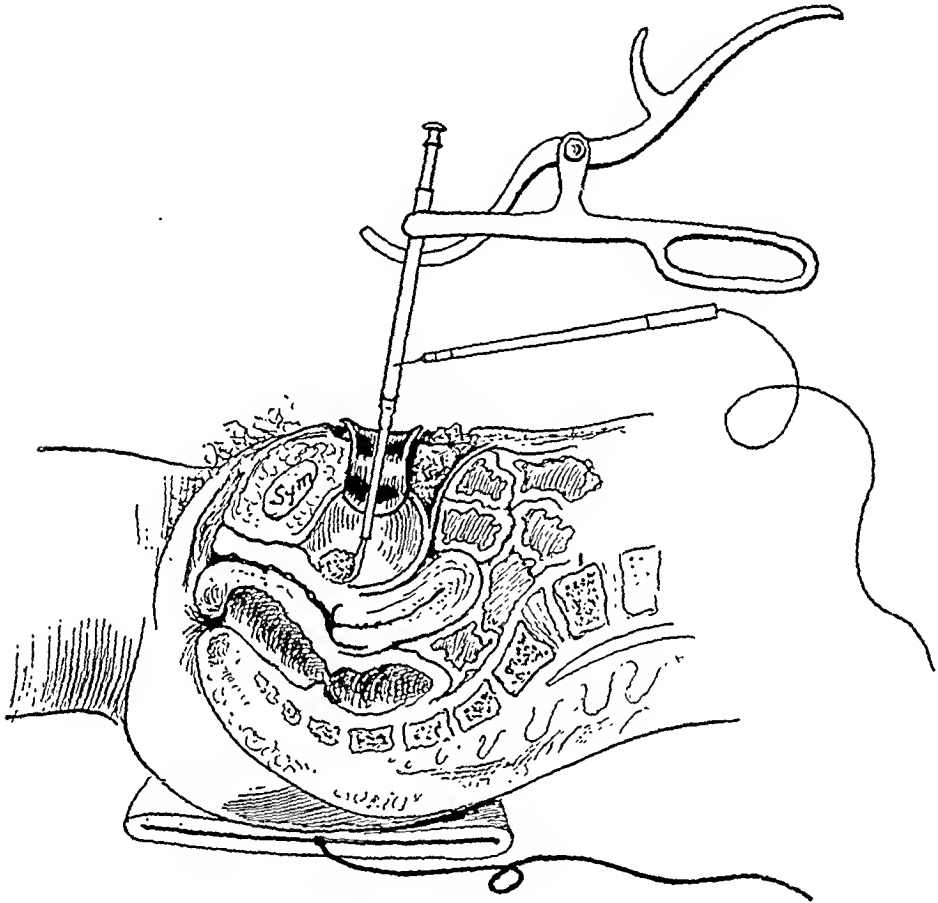


FIG. 766.—CLARK'S METHOD OF COAGULATING PEDICLE OF BLADDER PAPILLOMA THROUGH SUPRAPUBIC INCISION, USING TONSIL SNARE AS ACTIVE ELECTRODE.

Note inactive electrode beneath buttocks.

Great care must be taken not to short-circuit and burn the wall through contact of the side of the tumor with the bladder wall.

Suprapubic cystotomy is a better avenue of approach for large tumors, especially when the question of malignancy and the extent of disease is undetermined, as well as in all flat growths. Radium should always be used also as an adjunct. In extensive disease, especially in malignancy, heavy external radium radiation by the pack method or Ward's cylinder technique is an indispensable adjunct, bringing relief and even cure to this formerly distressing group.

Clark's technique is preferable for sessile and papillomatous growths. Figure 766. A tonsil snare embraces the pedicle snugly and with the bipolar

coagulating current the active electrode is applied to the handle of the snare and the current switched on while the loop of the snare is slowly drawn tighter, the tissues being coagulated as they are divided. This is accomplished with little or no loss of blood, and with the avoidance of dissemination of viable cells over an open wound.

Ulcer.—The results in the diathermy treatment of bladder ulcers are so gratifying and the technique so simple, that the current is quickly applied with little discomfort and no anesthesia. A monopolar (desiccating) current of fairly high amperage is applied by a long, well-insulated electrode inserted through an open-air cystoscope with the patient in the knee-chest posture. In the male, a water cystoscope is provided with an insulated wire as the electrode. The top of the electrode is applied to the surface until a white zone of dried tissue appears about it and then moved to an adjacent area and so on until the entire ulcer is treated, appearing as a piece of wet blotting paper. The desiccated tissue is left to slough off leaving a clean, healthy granulation to be covered by bladder mucosa. During the period of sloughing there is little if any inflammatory reaction in the surrounding healthy tissue.

The rapid change in the clinical picture is remarkable. Tenesmus, bleeding, and pain cease within the first twenty-four hours, the patient being able to carry on her usual activities with comfort. Walking or straining does not aggravate the formerly irritable bladder.

Any areas suspicious of malignancy should be treated with a longer application of a stronger current.

Dysmenorrhea.—During the last fifteen years there has been a growing interest in the electrical treatment of various other gynecological affections including dysmenorrhea. Turrell (*Proc. Roy. Soc. Med., Electro-Therap.*, 1916, 9) declares that "diathermy will give immediate and lasting relief in most acute cases of dysmenorrhea." Sloan (*Electrotherapy in Gynecology*, 1918) recommends diathermy on the autocondensation couch for functional or spasmodic dysmenorrhea. Corbus summarizes the benefits of diathermy in dysmenorrhea, "Dilatation of the vessels, relaxation of spasm and inhibition of muscle tone, improvement in blood supply, and consequent improvement in nutrition." In virgins he uses the abdominodorsal route, heating through the entire pelvis with from 800 to 1,200 milliamperes of current for thirty minutes and treating for a week prior to menstruation. In married women the thermophore is used in the cervix as in endocervical infections.

The Urinary Tract.—As noted, the experiments of Bowman throw considerable doubt on the efficacy of so-called medical diathermy. It is difficult to understand how the passage of an electric current through such a large heterogeneous conductor as the body can materially raise the temperature of an internal organ, as lung, kidney, or pelvic organ. However if theory militates against fact, so much the worse for theory. More study and observation of temperature readings are needed to clarify the situation.

There is clinical evidence to support the belief that medical diathermy actually does induce changes, bringing about relaxation of muscle and alleviation of pain with a general tonic effect.

Stone (*Med. Rec.*, 1921, 100) acclaims diathermy as palliative in tenesmus, frequency and dysuria, in cystitis, and urethritis. Small stones in the ureter are passed more readily and with less pain, due to muscle relaxation.

Other Operations.—We have used the *acusector* extensively in place of the scalpel in laparotomy, suprapubic cystotomy, salpingectomy, oöphorectomy, hysterectomy and panhysterectomy, appendectomy, intestinal resection and anastomosis, in making a vesico-vaginal fistula, in trachelotomy for the removal of intra-uterine fibroids, and in opening the pelvis for drainage. In all these, there has been an appreciable reduction in the loss of blood by sealing of the capillaries.

Hemostasis is secured by Ward's technique, Figure 767. Larger vessels not sealed by the *acusector* are clamped with the *acustomed* hemostat and coagulated with the damped bipolar current. When the operator is ready for permanent hemostasis the *acusector* current is cut off and the damped coagulating current turned into the active electrode and applied to the clamp, held at an angle to

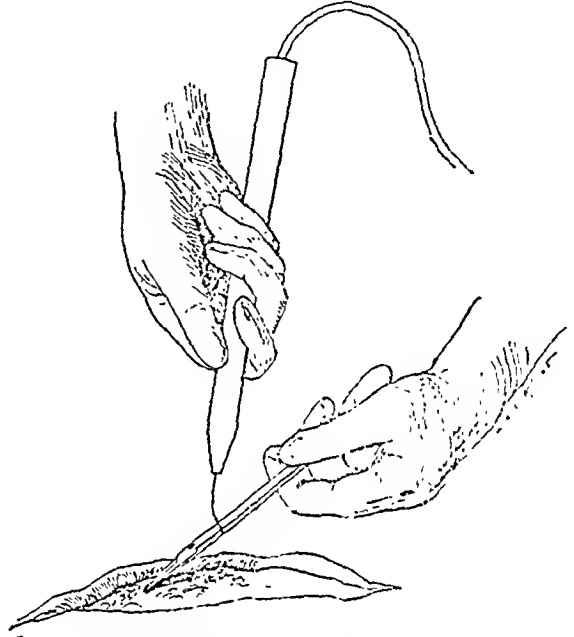


FIG. 767.—COAGULATION OF BLOOD-VESSELS.

Clamp grasping vessel serves as active electrode.

the tissues, not touching any part of the patient except with its tip. The current is continued until a small ring of coagulation is seen at the tip of the clamp, in about three to eight seconds, avoiding the introduction of a ligature.

Suprapubic cystotomy, salpingectomy, oöphorectomy, and hysterectomy are facilitated by the reduced capillary oozing, particularly in inflammatory conditions. One quickly sterilizes a cervical stump and upper canal with the coagulation current by heating the exposed parts to a lethal temperature. In removing adherent tumors in infection or malignancy, a thorough sterilization can be effected by a judicious coagulation.

Intestinal operations offer a wide field for the *acusector*, adherent loops of bowel are separated expeditiously by cutting the current down to a fine almost invisible spark. In resections and in opening the gut for anastomosis the *acusector* lessens the capillary hemorrhage.

Appendectomy is done by amputating between the crushing clamps with

the acusector and coagulating the base with a mild current, avoiding damage to the intestinal wall; in one instance a small area of cecum immediately surrounding the stump was coagulated and turned in.

Coagulation of inoperable metastatic glands *in situ* offers one of the great opportunities in cancer surgery. Each affected gland is coagulated and destroyed by inserting the needle and turning on the current until the entire gland is whitened, when the dead tissue is left to be absorbed.

Peritoneal implants of papilloma and carcinoma are treated in the same manner. An implant in the intestinal wall should be inverted with mattress-sutures after treatment.

In areas of malignancy clinging to the mesentery or pelvic walls, the remaining disease can often be destroyed by desiccation or coagulation. A striking instance was that of a woman with a large recurrent ovarian carcinoma, which responded at first to deep radium therapy and then became resistant. A bimanual examination showed a slight mobility. Operation was urged and the massive growth was found to be cystic and adherent to the bowel and pelvic wall. As much of the tumor was resected as possible, the large adherent portions thoroughly coagulated, and the abdomen closed without drainage; an uneventful recovery followed. When examined several months later there was no discoverable trace of the trouble. We are inclined to believe that the time is at hand to treat all metastatic inguinal glands by coagulating and then either curetting out the débris, or if the gland is small, leaving it to be absorbed; the entire capsule must be included in the treatment (H. A. Kelly and G. E. Ward, *Surg., Gynec., & Obst.*, 1926, 42).

Small uterine fibroid tumors discovered incidentally while operating can be coagulated and left for absorption, saving suturing and any annoying bleeding.

In treatment of epithelium-lined cavities Ward (*Med. Rev. of Rev.*, 1925, 32) has reported the cure of a ranula opened, evacuated, and treated with the high frequency current, leaving a soft almost invisible scar, and changing an awkward operation to a simple one.

In a large adherent postoperative hernia of the linea alba the sac was opened and the entire lining desiccated and the abdominal incision closed as usual, the "dead sac" being obliterated by simple suturing. The wound healed *per primam* and there was no recurrence.

A large graafian follicle cyst found in each ovary was opened with the acusector and evacuated, the lining desiccated, and the sac obliterated with a catgut suture. This is available in any small benign cyst of the ovary and promotes conservatism.

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CHAPTER XLIX

SOME TOPICS OF COMMON GROUND BETWEEN GYNECOLOGY AND PSYCHOPATHOLOGY (PSYCHIATRY AND MENTAL HYGIENE)¹

ESTHER LORING RICHARDS

GENERAL DISCUSSION

DEVELOPMENT AND MANAGEMENT OF SEX INSTINCT DURING PRE-ADOLESCENCE

- Early Curiosity and Ways of Meeting It
- Overemphasis on Attention to Personal Appearance
- Unhealthy Parental Attachments
- Auto-erotism (Masturbation)

MENSTRUAL FUNCTIONING AND MENTAL HEALTH

- Infantilism
- Amenorrhea Associated with Emotional Insults

BEHAVIOR ANOMALIES OF PERSONAL ADJUSTMENT TOO FREQUENTLY PROJECTED INTO REALM OF GYNECOLOGY

- Diffuse Physical Complaints Often Unconscious Substitutions for Poor Adaptation to Situational Difficulties
- Tension States with Outbursts of Anxiety and Obsessive Fears Usually Indicative of Emotional Strains Related to Sex Conflict
- Localized Pelvic Discomfort in the Setting of "Nervousness" Representative of Mismanaged Sex Tension

RELATION OF MENOPAUSE TO NERVOUS INSTABILITIES

General Discussion.—There is perhaps no department of medical science in which idiosyncrasies of behavior have been so uniformly associated with abnormal body functioning as in the field of gynecology. Long before diseases of women became a recognized surgical specialty, the reproductive system of the female was accused and convicted of entire responsibility for every distressing behavior anomaly, from bad temper to the grave instabilities of mental disease. Hysteria, named by the Greeks to cover a wealth of nervous symptomatology supposed to be due to the wanderings of the uterus throughout the body, is still

¹The writer has endeavored to present and arrange certain general principles of investigation and treatment based on Adolf Meyer's genetic-dynamic psychiatry. To accomplish this within an allotted time and space has necessitated the elimination of many details associated with such points of view in the field of psychopathology as those of psychoanalysis, endocrinology, focal infections, anthropometric studies in the correlation of psychoses and prepsychotic personalities, and recent developments in the Krapelin School. All these trends of research are offering important contributions to the study, treatment and prevention of poor mental health.

defined by a modern encyclopedia as "a nervous affection to which women are subject."

The sexual life of woman has always been productive of great interest and discussion in every period of history. This is due partly to its vital association with the family as a unit of society in different stages of civilization, and partly to the mystery that has surrounded the biology of reproduction. The latter has been cleared up a little through the study of embryology and histopathology, so that changes of gonadal function from prepubertal status to senescence have become more understandable. In the course of the vast amount of research incident to the establishment of more facts on the anatomy and physiology of the female reproductive mechanisms, there has been opened up a field of biochemistry as yet untouched. The ovary and its relation to endocrinology is an unwritten chapter in medicine, but one which in years to come will undoubtedly throw a great deal of light upon neuropsychiatry and gynecology.

From a more or less behavioristic standpoint the sexual activity of woman has been discussed from two angles by physician and layman. On the one hand, there has been a tendency to regard woman as a sort of supernatural element in life, superior to man; on the other, there has been a tendency to regard her as peculiarly endowed with sex instinct. The evaluation of each viewpoint was not based on a scientific study of actual facts, so much as upon religious and philosophical attitudes prevailing in society from time to time. For example, in the early classical period, when discussion of human relationships was simple and direct, we find woman expressing her love and sexual longings as naturally as any other emotion.

During the medieval period in Europe the easy virtue of woman was a frequent topic of literature and art, acting, perhaps, as a subtle rationalization for the difficulties that kept man from living up to ideals of asceticism fashionable at that time. Even Montaigne speaks of woman as a greater adept in the art and practice of love than man, because "it is a discipline born in her veins." From the latter part of the seventeenth century, down through the eighteenth and nineteenth centuries, this attitude changed to one of almost aggressive contradiction. The glorification of innocence, modesty, and weakness was carried to absurd extremes in the portrayals of heroines so frail and delicate as to be unfit to cope with the rigors of ordinary education, or reasonable exercise in the open air, or the competition of earning a livelihood. Their nervous systems were so sensitively constructed that even petty annoyances could legitimately be followed by tears, headache, irritability, and exhaustion. The sexual instinct and the management of its natural feelings was treated with equal sympathy. Sexlessness was considered the spiritual ideal of femininity.

How far such opinions influenced the physician of those times cannot be said, but it is hard to believe that scientific observation alone produced some of the statements accredited to it. Lombroso is quoted as saying that "woman is naturally and organically frigid." Löwenfeld states that in normal girls

sexual feelings are absolutely unknown. Windscheid goes still further in saying that "in the normal woman the sexual instinct is acquired, not inborn; when it is inborn, or awakes by itself, there is abnormality." Lawson Tait, writing on "Diseases of Women" in 1889, remarks that "the sexual instinct is very powerful in men and comparatively weak in women."

Such hypotheses gave rise to grave misconceptions concerning the relationship between behavior idiosyncrasies in women and the organization and functioning of their reproductive mechanisms. Even now it is not uncommon in practice to meet women who have been advised to marry to cure their nervousness, or women who have had panhysterectomy or suspension as treatment for obsessive fears and attacks of anxiety, or little girls whose precocious sexual activity has been medically interpreted as a sign of imminent insanity.

On the other hand, the development and utilization of a practical psychology, together with a more biological attitude towards problems of behavior on the part of medical science, have resulted in an intelligent understanding of human behavior in general. As such, it is not a question of whether man or woman has the greater sex impulse, but how each handles the native endowment individually or in marital combination. Or again, there is the question as to whether we will accept sex instinct as the one dynamic force of individual and group behavior, or whether we regard it as merely one of many instinct-wants to be guided and managed as part of our whole emotional adjustment. In other words, behavior is a very individual matter and cannot be treated from the standpoint of medicine and hygiene in the abstract with certain routine procedures for "neurasthenia" and "psychasthenia."

If one meets with bereavement, or serious disappointment, or failure, he is sad, depressed, downhearted. His mood hangs like a cloud over the whole personality, affecting the functioning of the individual as a whole; appetite and sleep decline; gas and belching may develop; intestinal peristalsis becomes sluggish; the heart beats slower; blood-pressure is apt to fall; the head aches, throbs, and "swims." If one experiences a shock or fright, or undergoes a long period of anxiety, every system in the body again responds to the emotional state: the heart becomes rapid, palpitates, or skips beats; the mouth is dry; the throat seems to close with a lump; respirations may become sighing; kidneys and bowels are more active; the skin feels hot and moist. This wealth of symptomatology represents an unconscious protest of the organism as a unit against strains of life to which adaptation must be made. The intelligent physician of to-day cannot so easily ascribe these complaints to an asthenia of the neuron, for which a therapy of fattening and isolation must be automatically prescribed. Having ascertained that no physiological abnormality is playing a leading rôle in the specific picture of distress, he next inquires into the history of the patient's lifelong habits of adaptation. Contributing to this are facts of constitutional endowment (hereditary tendencies to nervous breakdowns, chronic alcoholism, mental retardation, ne'er-do-wellness, and other

streaks of oddness in the family tree); the environmental influences of childhood, early habit training with development of characteristic methods of adaptation to home and school and occupation and family relationships and marital responsibilities. In short, the physician reconstructs the behavior story of his patient from childhood, just as he reconstructs the story of early nutrition, infections, operations.

Treatment of the nervous invalid thus ceases to be a more or less mechanical procedure of focusing attention on an ideal weight, and becomes intelligently guided by a common-sense evaluation of facts which have led up to the patient's bending or breaking under the pressures of life. Medical consideration of the active principles of behavior in the treatment of poor health has led to the creation of another and broader field of psychiatric medicine, the field of mental hygiene, which deals with a study of conditions—social, educational, familial—that have a vital bearing upon the mental health of childhood and adolescence. Just as childhood has been found to be the strategic point from which to attack heart disease and rickets and tuberculosis, so is it the place to give human beings the right start in habits of emotional control, in wholesome attitudes of parental relationships, personal strivings, and instinctive satisfactions. Accordingly it is from the standpoint of sex adjustment as a part of the functioning of the integrated personality that some topics of common ground between gynecology and psychopathology are discussed.

Development and Management of Sex Instinct during Preadolescence.—

The new psychology, in its analysis of behavior, ascribes the motive power of conduct to two primitive instincts: The self-preservative or the ego instinct, and the race-preservative or the sex instinct. The object of the ego instinct is to gain domination over the environment through the medium of power exhibited in various forms. The object of the sex instinct is to gain pleasure and to reproduce the race.

During the growth and development of the ego instinct in its efforts to gain sway over the environment, certain common facts stand out. The newborn cries at the first discomfort associated with hunger, untidiness, defective temperature, or pain. Soon these factors can be ruled out in individual instances of crying, and mother or nurse begins to realize that this cry is for the relief not merely of physical discomfort; the cry expresses desire and longing for other forms of satisfaction, such as holding, rocking, petting. As the infant grows into early childhood, it should learn, if properly trained, that there are limitations to the possibilities of what this cry will bring. The small organism discovers that it cannot have all sorts of food, and a light burning outside the bedroom at night, and parents jumping to anticipate wishes, and the grown-up world of home and callers completely disorganized by incessant demands. With this concept that every desire cannot be achieved through the medium of tears and whining, the child begins to think of the wishes and comfort of people around him, realizing that in this there is more pleasure gained than in an

attitude of constantly antagonizing them. Such a wholesome start in early behavior reactions enables a child to enter the school period well equipped to meet its adaptive requirements. Competing with children who have never learned this means of getting on with environment gives the well-trained child a distinct advantage. With even a mediocre intellectual equipment, the small personality finds school work easier because of mechanisms of control and self-restraint which are no hardship in their practice. Habit seems to take care of the handling of impulses. In short, such a child has converted the energy of his ego drive, or instinct, into forms of behavior which are thoroughly constructive. Whereas an untrained child finds all this mass of energy running wild and unproductive of anything but trouble for self and other people. Child No. 1 is not the victim of repression, but the master of restraint.

Very closely allied with the ego instinct is another specific energy—the race-preservative or sex instinct. In the lower animal forms we see this instinct only in its prime rôle of reproduction. In the higher animal forms we see it expanding into the maternal instinct. It is in human beings that one sees the inclusive possibilities of the sex instinct. In civilized races the object of reproduction becomes more and more disguised, masking itself often in the guise of pathological and enslaving parental attachments; in the evolution of love objects of childhood (animals, dolls, servants, playmates, etc); in devotion to dress and personal appearance, and in many other characteristics of everyday life for which society has a place. It is in this broad sense of associated goals that we have to consider the expressive activities of this great human energy.

When does the sex instinct begin to show itself, and in what way? According to the conservative estimate of previous generations, sex instinct came like conversion, sometime between puberty and twenty years of age. At least this was the time when it could appear in woman with decency and self-respect to all parties concerned. For the child to evince curiosity along such lines before that period was considered wicked, and persistent curiosity might indicate moral degeneracy. Great pride was taken by mothers in prolonging the “innocence” of their progeny—especially the daughters. All sorts of expedients were used to surround this aspect of life with mystery and fear, on the ground that silence, so far as questions were concerned, meant inward composure and the nonexistence of curiosity. Purity and ignorance were practically synonymous terms, just as were knowledge and uncleanness. Girls entered marriage without the slightest wholesome preparation for its responsibilities, and in turn grew up and allowed their daughters to do the same thing. While this custom had a good object in view, it overlooked the fact that the sex instinct and its allied interests have to do with dynamic forces in human nature which cannot be smothered at will. Merely putting a ban on mentioning this topic has never eradicated the curiosity of child or adolescent, but it has done tremendous harm in shrouding this whole subject in distorted and unhealthy ideas.

Early Curiosity and Ways of Meeting It.—Now any kind of curiosity is insatiable in a normal child. It is part of his explorative mechanisms of *how* and *where* and *why*. The disentanglement of self from stockings and bed-covers, the fitting of shoe to foot, the manipulation of buttons and strings, denote initiative and ingenuity in practical orientation that is recognized as a sign of healthy mental growth. With the acquisition of language the child continues to satisfy curiosity about many things: The external structure of the body, the difference in methods of voiding in herself and her small brother, the way fluids and food go through and leave the body. All these queries are natural in that they have a personal relation to the self which is being discovered from day to day. Straightway mother and nurse begin to instill lessons of sexlessness. "Nice little girls do not talk about such things!" The child ceases questions but not curiosity, and turns to other sources for satisfaction, detecting and remembering the embarrassment and hurried petulance of the older person. In a little while the behavior of animals and the arrival of puppies and kittens and babies call for more explanations. Where do they come from? "Brought in the doctor's bag," "Fished out of a frog-pond," "Bought in a store," she is told in a manner and tone of voice that not only carries little conviction, but casts a heavy frost upon further inquiry from any legitimate source. With silence but unabated energies she begins to listen at doors, peep through keyholes, tease servants, and finally has dumped upon her a shower of information that confirms her growing suspicion that the advent of life is associated with bad and indecent facts which grown-ups know but do not talk about.

In answering the queries of childhood concerning such matters, it is of vital importance to meet these issues as naturally and frankly as one meets curiosity aroused about any other matter. Answer the child's questions as they come up by simple statements of truth which can be added to from time to time, but need never be retracted. It is not necessary to go into details that are confusing. Such an attitude of frank response preserves the confidence between parents and child, or physician and child, and forges links of understanding that later on are essential to the adjustment of any difficulties in the sex life that may arise. Nothing bruises the sensitiveness of a child so much as realizing that a grown-up does not take its honest questions seriously.

Overemphasis on Attention to Personal Appearance.—Another faulty parental attitude which has its bearing upon the child's start in good habits of sex adaptation is the emphasis put on attention to personal appearance. From the cradle on the little girl is encouraged to think of her appearance. Esthetic coloring of wearing apparel, the starched precision of dresses, the way she sits and stands and walks often constitute topics for continuous maternal nagging, militate against spontaneity of action and mood, and keep sexual differences uppermost in the child's mind. The daily reminder that "no nice little girl acts this way" makes the child feel that she is expected always to act a part, behaving quite differently in play from her brother and other boys. It does not

take a bright little miss long to discover that this urge toward making herself attractive is for the purpose of finding favor in the eyes of the opposite sex. In this way she learns early to enter the ranks of competition with her kind. Mothers need frequently to be reminded that it is from just such a start in early training that sophisticated twelve-year-old coquettes develop.

Unhealthy Parental Attachments.—In following any given child through development to adolescence one notices that the object of its affection changes frequently. Inanimate and animate objects—dolls, pet animals, servants, playmates, teachers—have their day of devotion and are in turn replaced by some new enthusiasm. The affection of childhood is fickle and wavering as the personality grows and develops year by year, with its daydreams and ever-changing world of make-believe. It has been stated that such vacillating affection is more common in girls than in boys. No reliable evidence has ever been produced to prove such a statement, except the “crush” frequently seen among schoolgirls. One must not take this phenomenon too seriously with an interpretation of homosexual trends, but remember that it is only within the past few years that girls have not been seriously restricted in their outlets for recreation, amusements, and natural social intercourse with boys of their own age. Educational segregation, taboo of athletics, and insistence upon an existence of being “seen and not heard” threw them too much upon the company of each other, and the few resources for enjoyment that society considered in keeping with the modesty expected of their sex. A commoner and more serious fixation of the affections in childhood is that which is more or less cultivated by the mother to compensate for feelings of loneliness or neglect. Girls are more frequently the victims of such unhealthy attachments than boys, because of their tractability, intuition, and ready sympathy. In too many families one finds children taking sides with parents, though strict neutrality is proclaimed by all. Many a nervous, hypochondriacal woman dates her habits of instability to a childhood of almost exclusive maternal companionship in which she listened to physical complaining, financial worries, and nagging accusations against her father. Every attempt to emancipate herself through play, companionship of friends, and even marriage was construed as lack of “consideration” for the mother. “You will not have your mother always!”

Such pictures of maladjusted childhood come frequently into the physician's hands as “nervous,” “anemic,” “run-down” little girls. Great care should be taken to investigate all the facts of the case, and not hastily dispose of matters with a few cut-and-dried prescriptions, such as, “Take her out of school for a few months,” “Send her to the country where she can have fresh air and fresh food” “Wait until puberty and she'll outgrow it.” Such medical attitudes cause child and parents to project upon the combination of feminine reproductive organization and nervous system all sorts of poor mental health—tears, whining, tantrums, tired feelings. It is in just such childhood settings that nervous invalidism, with its fatigue, insomnia, phobias, and discontent,

gets a start, and throughout life the menstrual functioning becomes a scapegoat for every form of pathological behavior.

K. J., ten years old, was referred for insomnia and tantrums of sobbing when the mother went out of her sight, supposed to date from an attack of "grippe" some time before. There was nothing to suggest that the "grippe" was an encephalitis. In looking back over the child's history, one found a precocious intellectual development (Binet-Simon intelligence test showed a mental age of twelve years at the time of examination). She had been brought up in out-of-the-way places where there were no playmates considered suitable for her. There had been no consecutive schooling except the mother's tutoring. She was large for her age, and found herself at ten years in a large private school where she was obliged to do extra work to qualify for the desired grading. The "grippe" meant more work still when she returned to school. She hung on to its symptoms. Rest in the country was prescribed. The child demanded to leave her own bedroom and sleep with the mother. The doctor advised yielding. The mother gave up outside engagements and specialed her daughter. She was considering permanent withdrawal from school and continuance with tutoring until puberty arrived. Treatment in this case involved common-sense management of family problems, with removal of the child from home environment to that of a good boarding school, where she could be initiated into a few simple principles of habit training.

Auto-Erotism (Masturbation).—According to popular medical and lay ideas, auto-erotism is a practice which ruins the physical health, and if persisted in leads to insanity. Now this is a great and harmful delusion, based on the fact that auto-erotism is commonly seen openly practiced by inmates of institutions for the insane and feeble-minded. These patients are lacking in inhibitions associated with this practice, just as they are lacking in inhibitions in other spheres. They spit on the floor, void on the floor, take off their clothes, eat with their fingers. But no one would say that these practices were the cause of insanity and feeble-mindedness. Yet that is what tradition has done to auto-erotism. By virtue of this widespread and erroneous belief, large numbers of people are given over to worry and remorse and dread of future mental breakdown. The injury in auto-erotism does not come from the physiological part of the practice, but from certain psychological mental attitudes associated with it: first, morbid trends of mind associated with popular delusions about its dangers; second, habits of daydreaming and rumination concerning sex matters that constitute behavior substitutes for the healthy activities of play, athletic interests, and companionship which make for constructive adjustments in adolescence and maturity.

From the standpoint of the frequency with which this habit occurs in childhood, interesting facts are available. It was formerly supposed to be rare, especially among girls and women. This impression arose from a social attitude which frowned on any frank discussion of sex problems. Under the

popular influence of less conservatism in such matters, we have come to discover that auto-erotism is a very common practice in both girls and boys, and that it is a frequent phase in the evolution of individual sex life, occurring without much conflict, and disappearing when the stage of heterosexual adjustment begins.

From the standpoint of etiological factors, adherent clitoris and tight clothing sometimes play a rôle. More frequent, however, is habit formation initiated through nurse girls or playmates. The young child may stumble upon it in the course of body exploration, and finding the sensation pleasurable drift into it as an anodyne before going to sleep, or when bored with play. Thumb-sucking and curling a lock of hair may accompany the practice. Whatever the cause, its habitual continuance in intellectually normal children is almost invariably associated with some faulty damming up of energy outlet in the emotional life of the child.

A. B., a child of four years and three months, was referred for auto-erotism and thumb-sucking whenever left alone for a few minutes. In mental characteristics she was described as alert, "into-everything," persistent, and given to easy habit formation. Once taught a trick or new phrase, she never forgot it. Her hygiene of eating and sleeping was good. Her parents denied indulging the child, yet ten minutes in the family circle revealed the fact that A. B. was constantly being shown off, and her sayings repeated in her presence. Binet-Simon intelligence test showed a mental age of six years. Yet A. B. was forced to play with children of her own age with sandpiles and desultory objects of amusement which quickly bored her, and she began to quarrel with her playmates. Here was a child who needed kindergarten and vigorous games of competition to work off her energy. With these and the daily nap omitted, A. B. was thoroughly tired at night and went to sleep immediately. After following this plan three months, the auto-erotic activities were found to be replaced by the new interests suited to her precocious development.

J. S., eight years old, was brought by her mother and nurse in a state of panic because of auto-erotism to the point of vaginal discharge. The habit had been noted for over three years, and according to the child had been taught her by a nurse girl who probably found this a means of keeping her quiet. She had been given all sorts of treatment. Threatening to "cut" had been without effect. So had a steel contrivance into which her arms and legs had been locked at night. Her present nurse had been told never to leave her for a moment, and the instructions were faithfully obeyed. Under these procedures the child had grown sullen, embarrassed, and easily tearful. She was carried and brought back promptly from school, never being allowed to play with other children. Her only activities were reading, drawing, and piano playing. Bicycle, horseback riding, dancing were forbidden as too apt to excite her sexually. The child had even been taken through the grounds of a state hospital, and told that she would be "put away" there if she kept on.

The first step in treatment was to modify the emotional attitude of mother and nurse, who seemed unable to think or talk of anything else. Again a program of vigorous play was outlined. Athletics, folk dancing, riding, swimming, regular playground periods were instituted, with the elimination of all watching, steel frames, and tying of the hands. The mother was finally persuaded to try this régime for two months. The results to date have been most satisfactory. The change in the child's spirits has been marked.

In other words, treatment of this condition should be based on the fact that auto-erotism is an expressive outlet for energy. The latter must be turned into other channels that appeal to childish interests. Never scare, or threaten, or punish, or tie the hands. These methods may stop the practice for the moment, but they are barbarously cruel, and defeat their end by focusing the child's attention upon the habit more than ever through a conditioned reflex of pain, restraint, and humiliation. Moreover, mechanical restraint does not do away with the daydreaming, which is, after all, the great danger associated with auto-erotism. Vigorous and organized play gives the daydream a chance to express itself in action going on in the open and shared by companions. The daydream of auto-erotism is associated with solitude, stealth, and a sense of guilt, which later on may crystallize into self-consciousness, seclusiveness, and many another antisocial trait characteristic of the maladjusted adolescent. The early development of healthy expressive outlets paves the way for a satisfactory handling of urges and cravings arising at puberty, associated with the pressure of the sex impulse.

Menstrual Functioning and Mental Health.—Menstruation has always been considered a legitimate scapegoat for all sorts of behavior anomalies, nervous instabilities, and give-up reactions. Supported largely by medical tradition, mothers have been wont to lay down a régime that involved a period of invalidism for their daughters lasting one week out of every four. Staying out of school, lying in bed, rigid restriction of exercise, elimination of baths were supposed to be absolutely necessary to give the menstrual functioning its best chance. The result was that this phenomenon was approached with horror and dread, and a great deal of the fuss made over its symptoms was undoubtedly due to the power of suggestion. This attitude has gradually changed as women have become less proud of "poor health" and "high-strung temperament." Discomfort is minimized instead of exaggerated. Ordinary activities are not interfered with unless the dysmenorrhea is associated with serious mechanical or physiological causes giving rise to severe pain.

There is, however, a definite and subtle relationship between menstruation and the nervous system which is very imperfectly understood. For example, there is in some women a marked tendency to moodiness and instability prior to the onset of the period, which disappears as soon as the function is well started. This phenomenon is usually present in women who from childhood have a history of being touchy, hypersensitive, petulant, and labile in their

reaction to strains of any kind. A hard cold, difficulties in school or business, disappointment in plans, friction of personal contacts causes them to bend emotionally just as does the menstrual cycle. Sometimes this bending culminates later on in a frank depression, or a more serious type of nervous breakdown; sometimes not. The criterion is an individual matter, and seems to be more dependent upon the constitutional endowment and mental hygiene habits of the patient, than upon any factors associated with the reproductive organization.

A more striking illustration of the relation between menstruation and nervous system factors, structural and psychological, is seen in:

Infantilism.—Associated with the total picture of immaturity in bodily development goes a delayed appearance of menstruation, often followed in a few years by a complete amenorrhea. The psychic changes in these patients vary. On the one hand, there may be a stunting of the personality development so that the individual goes through life with the tastes and viewpoints and ambitions and judgments of a sixteen-year-old adolescent. Or she may show progressive regression with the development of simple habit deterioration of the schizophrenic (dementia precox) group. Here we are again confronted with the unsolved problem: Are such phenomena due to cessation of menstrual functioning, or is the amenorrhea merely part of the general slumping of the individual as a whole? Psychopathology is inclined to favor the latter theory.

Amenorrhea Associated with Emotional Insults.—It is not uncommon to meet patients in whom menstruation has suddenly ceased following some profound emotional experience.

B. C., a woman of thirty-four, seven years ago ceased menstruating following the sudden death of her mother who had not been well for several days but was not considered seriously ill. The patient was supposed to give her medicine at a certain hour, discovered that a few minutes of the required time had slipped by, and left the room to prepare the dose. When she returned her mother was dead. She became panicky and self-accusatory, though she had good insight into the fact that the mother's life could not have been saved by the medicine. For two or three months she was depressed, but cleared up without hospitalization and resumed her secretarial work. Since then her great urge has been restoration of the menstruation. All gynecological treatment has been without avail. It seems that the patient had been engaged to a man whom the mother opposed. Since the mother's death she cannot make up her mind to marry him, excusing her indecision by arguing that it is not right for her to marry thus handicapped for the responsibilities of marriage. The patient was the oldest daughter and burden-bearer. Brought up in a home of interparental disharmony, she had sided with her mother and had almost an obsessive attachment for her. As a girl and young woman she would not go away even for a night without self-accusatory worry. Although her mental unrest has never culminated in a frank breakdown, one wonders what rôle

her continuous conflict plays in preventing the return of the menstrual periods.

In the course of depressions or excitements, one often finds an amenorrhea extending over many months, with a return of function as soon as the emotional stress subsides.

Behavior Anomalies of Personal Adjustment Too Frequently Projected into the Realm of Gynecology.—In approaching the “nerves” of adult life, the physician who does not take the time or trouble to go into the life story of his patient’s adaptative struggles from childhood, often misses the real medical problem in an attempt to treat isolated symptoms. This fact is well illustrated if one takes the word neurasthenia and traces its evolution during the last fifty years through the *Index Medicus*. In the beginning the term included physical symptoms referable to every system in the body, and “psychic” manifestations elastic enough to include every faulty behavior reaction except well-formulated types of organic brain disease and other major psychoses. From this heterogeneous group medical research has eliminated one symptom-complex after another, until now the term neurasthenia in its correct usage is applied only to those cases in which the symptom of fatigue predominates either as a disguised expression of discontent, discouragement, boredom, or as an expression of a constitutionally low tolerance to the strains of energy output. This term is now grouped under the psychoneuroses where also are to be found the obsessive phobias (Janet’s “psychasthenia”; Freud’s “compulsion neurosis”); hypochondriasis going on frequently to chronic invalidism; anxiety neuroses (attacks of palpitation, dyspnea, precordial distress with fear of impending death—Freud’s *aktual neurosen*). The differentiation of these symptom-complexes has been achieved through a more careful study of human functioning by medicine and psychology. By virtue of such study, principles of treatment have changed. Progressive medicine now recognizes that the nervous symptomatology represents a substitution for individual difficulties of adjustment to life, such as economic strain, marital friction, personal conflicts in the sex life. These sources of inquiry should always be carefully investigated before gynecological treatment is instituted as part of a blind groping after causes of complaining distress. Is the “moderate degree of retroversion” causing all the headache, fatigue, and tearful irritability? Or are there factors which are making the patient unconsciously utilize this slight abnormality to the point of invalidism? There is still too great tendency among practitioners to treat hastily without due consideration of all the facts of each individual case.

Diffuse Physical Complaints Often Unconscious Substitutions for Poor Adaptation to Situational Difficulties.—In a group of thirty-nine chronic invalids treated on the wards of the Phipps Psychiatric Clinic of the Johns Hopkins Hospital, fourteen, or 36 per cent, had received active gynecological therapy (tampons, pessary, dilatation for ureteral strictures, operative proce-

dures) for such complaints as "headache, stomach trouble, insomnia, eructation, burning sensations over the body, attacks of palpitation, anorexia, dizziness, exhaustion, flatulence." Operative treatment for such complaints included dilatation and curettage, suspension, and panhysterectomy. Following these procedures the patients still continued to complain. Study of each case revealed the fact that these complaints were unconscious substitutions for such adaptive difficulties as alcoholism of the husband; unreasonable jealousy; rebellion against more children and consequent drudgery; inequality of sex desires in the marital combination; loneliness of empty middle age; lifelong feelings of inferiority with discrepancy between ambitions and capacities.

In considering the above cases of serious hypochondriasis it is worthy of note that gynecological treatment was evidently instituted on the belief that these complaints must be reflex phenomena. In no instance was it possible to elicit from the patient history of any serious menstrual dysfunctioning aside from an occasional delayed period, or some dysmenorrheal backache and "cramps."

X. Y., married, thirty-five years old, referred for "nervousness and gas in stomach," was considered a "nervous, delicate child." Mother was always ailing and "under the doctor's care." Menstruation began at thirteen years. Patient taught to be an invalid at her periods; stayed home from school and in bed during the first twenty-four hours. She married at twenty-two. First pregnancy resulted in miscarriage at six weeks. There are two living children. Patient desires no more. Six years ago she became tearful, complaining of headache, insomnia, and belching. Her husband had undertaken a business venture that took him away from home a great deal. One ovary was removed. The doctor told her it was cystic; told husband that the other one might become so. Yielding to patient's importunities husband gave up his business and "settled down" to small activities in the home town. He became silent and disheartened. Patient accused him of being interested in another woman. Former symptoms became worse. There was no disturbance in menstrual flow and backache. Gynecological examination in the Johns Hopkins Dispensary showed no abnormality but a relaxed outlet, and she was transferred to the psychiatric service.

M. L. came from another state to the Johns Hopkins Dispensary complaining of "general nervousness, pain all over, waves of exhaustion on the slightest exertion." She had a childhood and adolescent background similar to that of X. Y. At thirty years she could not walk without support. She wore dark glasses because light hurt her eyes. In 1918 she had had her first D and C for dysmenorrhea. In 1919 an appendectomy was done. In 1920 she married. In 1922 she had a second D and C. In 1924 a fibroid was removed from her uterus. In 1926 she had a complete hysterectomy. Thorough physical examination made in the dispensary was negative. The husband had taken on all the oversolicitude of the mother, and had never allowed her to do any work

since marriage, had shielded her from social contacts, and had taken means to prevent conception because of the patient's fear of childbirth. Every surgical intervention increased the demand for more, until she was practically bedridden. Husband and wife left our dispensary thoroughly disappointed that no physical cause was found to account for her condition.

Tension States with Outbursts of Anxiety and Obsessive Fears Usually Indicative of Emotional Strains Related to Sex Conflict.—In certain individuals with constitutional tendency to easy panic and nervous fears there occurs in adult life attacks of palpitation, precordial distress, dyspnea, and vivid fears of impending death. During an attack one sees a terrified person. There are tachycardia, sweating, tremors, and breathlessness. The patient does not complain of pain as in angina, but of cardiorespiratory sensations that suggest to her immediate exodus. After one attack she lives in dread of another, and in course of time restricts her activities so that she becomes more or less of an invalid through fear of having seizures on the street or in other public places. These patients are frequently treated from the standpoint of hyperthyroidism, or gastric distention with pressure on the diaphragm, or from the standpoint of a mild cardiopathy for which a program of "go slowly" is advised. Focusing the attention on one or all three of these possibilities grafts more fear upon the fundamental apprehensiveness, until as time passes and attacks continue in spite of treatment, she becomes thoroughly hopeless with regard to herself. In many instances the menstrual function is affected with irregularities, marked dysmenorrhea, or a missing of periods now and then.

Examination of the emotional life of the patient invariably reveals facts that are of importance especially with reference to an unsatisfied sex adjustment. Freud goes so far as to state that all anxiety neuroses are caused by accumulations of somatic sexual excitement aroused by frustraneous attempts at satisfaction through coitus interruptus, excessive fondling, etc. For this reason he classifies the condition as a physioneurosis. Whether or not one always finds such causal facts associated with attacks of *angst* is a debated question, but there is no doubt that formal medicine too often fails in helpfulness to such patients by not considering these matters as a part of the medical approach.

Among the common factors of poor sexual adjustment are to be found lack of organic satisfaction in intercourse, due to difference in the native endowment of sex urge in each partner, or to ejaculatio precox, or to crude masculine approaches. More frequently yet as a causal factor is embarrassment and restriction of natural marital relations because of fear of pregnancy. Feminine conflicts over pregnancy play a far greater rôle in mental health than medical science appreciates. The fear of death from childbirth, or the dread of repeating a hard obstetrical experience are facts that many a woman feels but is ashamed to acknowledge because of her sense of duty to husband and society. Such personal conflicts are unconsciously projected upon the body, so that a large percentage of declines in health are dated from a childbirth. Another

matter commonly giving rise to sex conflict in marital relations is the combination of Catholic married to Protestant. Here is a situation that is bound to give rise to serious issues affecting vital personal beliefs, such as the use of contraceptives and the rearing of children according to the accepted persuasions of husband or wife. Another matter that falls within the province of medical inquiry is the patient's attitude toward limiting family formation because of financial reasons. In many a home the addition of each successive child means a lowering of economic, educational, and even hygienic standards. The burden of such sacrifices falls heavily upon the wife and mother, not only from the standpoint of her own personal hardships, but from the standpoint of having to see her children struggle with the handicaps of seriously inferior health and education. While her own official personality is attempting to deal with these matters through ethics, her unofficial personality is demonstrating its emotional protest through biological manifestations of distress that the physician is called upon to treat.

F. G., a married woman of twenty-eight, was referred for attacks of palpitation, dyspnea, dizziness, and apprehensiveness in which her legs would give out and she would sink to the floor. She had had these phenomena for two years, but during the past six months she had become more or less completely incapacitated. Her menstrual periods were very irregular, scanty, and accompanied by pain and chilliness. Physical examination was negative except for tremors of the tongue and hands, very active knee-jerks, and 10 pounds overweight. Basal metabolism was satisfactory. Gynecology reported, "Pelvic examination negative." The patient was tense, fidgety, and easily induced to tears. Her nails were bitten to the quick. She had come to the Johns Hopkins Hospital after having been treated by three different doctors. The last one had advised a thyroid operation. In going into her story one found the following facts. The patient is a Catholic married to a Lutheran. The husband is a kind, industrious, sober man. He married the patient in opposition to his family, and the latter has made things uncomfortable for the patient. There are two children. During the past two years the husband has been unable to obtain steady work owing to industrial conditions, and the family income has been unstable. He has not felt that he could support more children, and has taken precautionary measures against conception. The patient worried over this practice, and made it the subject of discussion at Confession. The patient's mental state is one of conflict between seeing the reason of her husband's attitude during the present economic crisis, and her life-long beliefs about the sinfulness of such measures. How much of her anxiety is due to this personal conflict, and how much is due to organic dissatisfaction associated with the procedure, it is impossible to say. The point of issue in therapeutics is seeing to it that she understands the nature of her difficulties so that she becomes more intelligent in the management of her sex problems.

Localized Pelvic Discomfort in the Setting of "Nervousness" Representative of Mismanaged Sex Tension.—1. Vaginal sensations of crawling, burning, pressure, bearing-down feelings are usually associated with auto-erotism and conflict. They are not infrequently seen during late middle life in single women, and widows, and married women whose husbands have shown marked decline in sex impulse. By reason of the patient's age, the habit of auto-erotism is not suspected and the difficulty is not elicited without direct questioning. The history is usually that of a person whose sex life has adjusted itself without marked difficulty so long as activities and interests remained diffuse and stimulating. With the gradual limiting of daily program coincident with advancing years, the patient finds herself thrown upon her own resources for satisfaction which she has never learned to develop. Life becomes drab to the point of irritation. She is restless, lonely, sensitive to lack of attention. Sex tension becomes a problem, and with it a sense of shame that she should be guilty of such feelings at her age. It is a matter that cannot be discussed with any one. The patient begins to visit doctors complaining of insomnia, fatigue, anorexia, and local sensations that are charged up to a slight hypertension or glycosuria, or beginning senile decline. Sometimes the patient develops fears of cancer, or vague germ phobias with suspicions and misinterpretations and seclusiveness.

W. Z., a childless widow of sixty, was referred for cancer phobia, insomnia, and pressure sensations above the symphysis. Since the death of her husband five years before she had given up her home and retired to a suburban boarding house where she found life dull after years of home interests. Church on Sunday, a daily walk, calling on a friend, an occasional game of bridge constituted her program week after week. She was unhappy, querulous, and lonely. She slept poorly, could not settle down to reading, did not enjoy her meals, lost some weight, was conscious of sex tension, gratified the desire, feared she had injured herself, began to worry about cancer of the vagina. Such a patient can be helped by giving her an opportunity for ventilative discussion, by giving her reassurance, and planning a daily program more suited to her energies.

2. Dyspareunia unassociated with any local abnormality is a defense mechanism against sexual relations accompanied by varying degrees of awareness on the part of the patient. In some women with phlegmatic temperaments there is little sexual desire, through no lack of love for the husband. Marital relations constitute a conflict between a sense of duty and a constitutional lack of desire. If the husband understands and is coöperative a reasonable adjustment is effected. If he is importunate the patient may work herself into a mental attitude that so reacts upon bodily sensation that coitus causes distinct pain.

Another common cause of dyspareunia is to be found in the sphere of the patient's affections. Decline in love for husband due to jealousy, with or with-

out adequate cause, or the gradual transplantation of the patient's own affections elsewhere creates a mental attitude of aversion to intercourse that may be projected upon the local mechanisms. The local discomfort can almost invariably be interpreted as merely part of far deeper maladjustment in the relations between wife and husband.

Relation of Menopause to Nervous Instabilities.—The frequency of nervous breakdowns in middle life has long been a matter of medical observation. The rather uniform character of the breakdown gave rise to the term *Melancholia*, coined by the Germans to describe a depression in which restlessness, anxiety, and agitation stand out more than in depressions occurring earlier in life. Because this type of breakdown is seen so often around fifty years of age the phrase *involution melancholia* became a symptom-complex in psychiatric classification. Among its causal factors are enumerated hereditary tendencies to breakdown (present according to White in about 60 per cent of cases), metabolic changes in the direction of destructive processes with special reference to gonadal atrophy, and secondarily some undue mental or physical strain acting as a precipitating agent. To these causal factors modern psychiatry would also add the cumulative effects of life-long habits of poor mental hygiene—attitudes of bitterness, pessimism, self-pity, fault-finding, and self-centeredness. From an adaptive standpoint, middle age is the most trying period of life to meet. Like Dante climbing the Mountain of Purgatory, the individual in middle age comes to a spot where he cannot but look back as he goes forward. Unlike that poet, however, the view is not always pleasant in retrospect. Disappointed hopes, unrealized ambitions, envious comparisons with self-depreciation chase each other like early winter clouds over the mountain ranges of the journey thus far traveled. Children marry and leave home, husbands die, friends drop out of the picture, economic conditions and ways of living change. It is at this point that an emptiness of life becomes apparent unless the individual has all the way along developed a philosophy with action currents within herself. Such an outgoing personality is not likely to bend beneath the strains of destructive metabolism, any more than she has under pregnancy. The ingrowing personality, on the other hand, consumes itself from year to year, bending more and more under successive strains.

The menopause is looked upon with a dread, much of which is traditional. It has been made the scapegoat of all sorts of faulty mental hygiene which does not fall into the category of psychoses. In the medical treatment of its problems the physician must again beware of applying a few cut-and-dried prescriptions. Even in the treatment of frank menopausal depressions a great deal depends upon what goals can be set for reconstructive efforts toward return to health. Medicine is a bit inclined to fall back upon the menopause as the one causal factor in the maladjustment of women in middle age, and to encourage them in the too often harmful tendency to settle down on part-time activities for the rest of their lives. Whereas, it is the encouragement to remain

in the traffic stream of life that holds for them the best chance of continuous nervous stability. In other words, from early childhood to old age, inferior heredity and inferior somatic organization are given a maximum advantage only with the establishment of wholesome habit formation.

INDEX

- Abdomen, blood supply of, 13
- four cardinal projections of pelvis and, 85
- inspection of, 88
- right, pathology in, 87
- Abdominal aponeuroses, relations of, 6
- Abdominal dressing, 409
- Abdominal hysterectomy, closure of wound in, 443
- extirpation by continuous incision from side to side, 434
- drainage in, 443
- horizontal bisection and, 441
- indications for, 432
- methods of, 433, 436
- sagittal bisection and, 437
- Abdominal muscles, anatomy of, 4
- Abdominal surgery, general principles of, abdominal dressing, 409
- adhesions, 396
- affections of abdominal incision, 409
- bladder irritability, 412
- blood-pressure taking, 402
- bowels, 412, 419
- closure of incision, 408
- consent of patient, 390
- drainage, 406
- embolism, 425
- examination of patient, 391
- excessive pain and sedatives, 419
- exploratory incision, 395
- exposure of field, 396
- facial expression, 414
- food, 411
- gum acacia glucose apparatus, 403
- health of surgeon, 390
- hemorrhage, 400
- ileus, 421
- incision for tubo-ovarian abscess, 396
- incision in fat women, 395
- intestinal hemorrhage, 426
- length of incision and how to find peritoneum, 394
- ligation of pedicle, 399
- nausea, 411, 417
- parotitis, 420
- phlebitis, 424
- pleurisy, 421
- Abdominal surgery, pneumonia, 421
- postoperative care, 409
- postoperative complications, 414
- preparation of patient, 392
- pulse, 413, 417
- recovery, 414
- resuscitation and transfusion, 401
- secondary hemorrhage, 416
- shock, 414
- sutures, 414
- temperature, 413, 417
- thirst, 411
- transfusion and resuscitation, 401
- tympanites, 418
- ureteral injuries, 398
- vesical injuries, 398
- visitors, 394
- vomiting, 411, 417
- Abdominal viscera, examination of, 84
- Abdominal walls, anterior, relation to sacral promontory, 10
- normal position and relation of, 64
- pelvic examination by rectum and, 72
- Abortion, repeated, organotherapy and, 156
- tubal, appendicitis differentiated from, 474
- ectopic pregnancy and, 705
- uterine hemorrhage following, 149
- Abscess, concealed, Skene's glands and, 825
- pelvic, complications of, 626, 632
- diagnosis of, 628
- extension of, 626
- history of, 624
- pathology of, 625
- postoperative care of, 633
- protein therapy and, 928
- restrictions of the term, 325
- symptomatology of, 627
- treatment of, 629
- suburethral, 824
- treatment of, 239
- tubo-ovarian, appendicitis and, 471
- incision for, 396
- myomectomy complicated by, 567
- vulvovaginal, 211

- Accessory tubal ostia, extra-uterine pregnancy and, 680
- Acusection, 993
- Acute antelexion, treatment of, 162
- Acute appendicitis, gynecological conditions differentiated from, 472
- pregnancy and, 478
- treatment of, 476
- ureteral stricture and, 876
- Acute cystitis, treatment of, 865
- Acute gonorrhoeal salpingitis, appendicitis differentiated from, 472
- diagnosis of, 650
- symptomatology of, 650
- treatment of, 651
- Acute infectious diseases, amenorrhoea during, 129
- Acute pyelitis, appendicitis differentiated from, 474
- Acute rheumatic fever, sterility and, 159
- Adenocarcinomata, cervical, 575
- myomectomy complicated by, 546
- ovarian, 743
- papillary, 745
- vesical, pathology of, 907
- vulvar, 206
- Adenomata, vesical, pathology of, 906
- Adenomyomata, inguinal endometriosis and, 800
- uterine, characteristics of, 618
- clinical picture of, 620
- hemorrhage and, 148
- history of, 618
- malignancy of, 622
- solènome, 799
- treatment of, 622
- vaginal, 385
- vulvar, 203
- x-ray treatment of, 963
- Adhesions, abdominal hysterectomy and, 432
- general principles in management of, 396
- myomectomy complicated by, 566
- ovarian tumors and, 779
- peritoneal, ectopic pregnancy and, 681
- Adiposogenital dystrophy, amenorrhoea associated with, organotherapy and, 155
- Adult pelvis, anatomy of, 2, 64
- Affections of abdominal incision, 409
- Agglutination of labia, 108, 114
- Alcoholism, protein therapy contra-indicated in, 928
- Alligator forceps, 816
- Allis forceps, 279
- Alterations, bladder, 836
- Amenorrhoea, emotional insults and, 1005
- endocrinology and, 152
- etiology of, 128
- radium causing, 952
- treatment of, 130
- x-ray producing, 960
- Anal fascia, anatomy of, 290
- Anemia, miscarriage and, 167
- Anesthesia, examination under, indications for, 84
- nitrous oxid plus oxygen, 84
- resuscitation during, 405
- sacral administration of, 429
- anatomical considerations of, 427
- bibliography of, 427
- selection of patient for, 428
- solution and instruments for, 429
- Angiomata, vesical, results of treatment of, 921
- vulvar, 191
- Angiomyomata, myomectomy complicated by, 549
- Angiosarcomata, ovarian, 758
- Anomalies, spinal, impinging spinous processes of lower lumbar vertebra, 459
- incomplete sacralization of first sacral vertebra, 459
- sacralization or fusion of fifth lumbar vertebra, 458
- backache differentiated from, 457
- spina bifida occulta, 457
- Anteflexion, acute, treatment of, 162
- Anterior colporrhaphy, 322
- Anus, muscles of, 31
- Aorta, abdominal, anatomy of, 13
- Aplasia, incidence of, 107
- Aponeuroses, abdominal, relations of, 6
- Aponeurotic space, superior, anatomy of, 292
- Appendicitis, acute, gynecological conditions differentiated from, 472
- pregnancy and, 478
- treatment of, 476
- ureteral stricture and, 876
- chronic, gynecological conditions differentiated from, 475
- treatment of, 476
- Appendix, diseases of, differentiation between gynecological conditions and acute appendicitis, 472
- pelvic organs and, 470
- positions of, 11
- Appendix vesicularis, Kossmann's, 766
- Arcuate arteries, 17

- Arcus tendineus musculi levatoris ani,
 290
 Arthritis, backache and, 467
 Ascites, abdominal signs of, 90
 fibroma of ovaries and, 757
 myomectomy complicated by, 556
 neovascular in, 415
 ovarian cysts and, 771
 papillary ovarian tumor and, 741
 radium and, 953
 tuberculous salpingitis and, treatment
 of, 670
 tuberculous, x-ray treatment and, 964
 Aspermia, congenital, 158
 Atmospheric distention of rectum, pelvic
 examination with aid of, 73
 Atresia, amenorrhea and, 129
 hymeneal, 219
 tubal, ectopic pregnancy and, 677
 vaginal, 114
 Atresia folliculi, 124
 Auto-erotism, 1002
 Autogenous vaccines, vulvar furunculosis
 and, 189
 Azoöspemia, sterility and, 158
- Bacillus mucosus capsulatus, granuloma
 inguinale and, 197
 Bacillus proteus, chronic hypertrophic ul-
 cerative vulvitis and, 201
 Backache, arthritis and, 467
 differential diagnosis of, 456
 fractures and, 466
 hypertrophic osteo-arthritis and, 468
 incomplete sacralization or fusion of
 first sacral vertebra and, 459
 infections and, 467
 lumbosacral strain and, 457, 460
 mechanical factors in, 460
 metastatic lesions and, 468
 neurological conditions and, 469
 orthopedic phases of, 456
 pathological conditions in bones and
 joints and, 464
 posture and, 462
 sacralization or fusion of fifth lumbar
 vertebra and, 458
 sacro-iliac strain and, 461
 scoliosis and, 459
 spina bifida occulta and, 457
 spinal anomalies and, 457
 spondylolithesis and, 462
 tuberculosis of sacro-iliac joint and,
 467
 Barrows ovarian suspension, 487
- Bartholinitis, edema in, 191
 electrotherapy and, 984
 gonorrheal, protein therapy in, 927
 Bartholin's glands, abscess of, 211
 acute inflammation of, edema in, 191
 adenocarcinoma of, 206
 blood supply of, 30
 carcinoma of, 214
 Cowper's glands the homologue of, 38
 cysts of, 209
 gonorrheal infection of, 637
 protein therapy in, 927
 histology of, 38
 primary tuberculosis of, 214
 sterility from infection of, 160
 tuberculosis of, 664
 Basal metabolism, 96
 Behavior anomalies, 1006
 Belt, sacro-iliac, 459
 Benign ectopic endometriomata, treat-
 ment of, 801
 Benign ovarian epithelial tumors, 727
 multilocular cystadenoma, 729
 papillary tumors, 738
 pseudomucinous cystoma, 734
 simple serous cystoma, 727
 Benign solid vaginal tumors, adenomy-
 oma and myoma, 385
 Benign tumors, uterine, adenomyoma, 618
 characteristics of, 496
 diagnosis of, 515
 form peculiarities of, 514
 incidence of, 498
 site of, 504
 symptomatology of, 498
 treatment of, 518
 x-ray treatment of, 521
 vulvar, 202
 Bicornuate uterus, 114, 242
 Bisection, horizontal, abdominal hysterec-
 tomy by, 437
 hysteromyomectomy and, 530
 sagittal, abdominal hysterectomy by,
 437
 technique of, 535
 Bladder, adenocarcinoma of, pathology
 of, 907
 adenoma of, pathology of, 906
 air or water distention of, 869, 894
 alterations and displacements of, 836
 anatomical relations of, 309
 anatomy of, 11, 22
 angioma of, results of treatment of,
 921, 922
 blood supply of, 21
 carcinoma of, pathology of, 906

- Bladder, carcinoma of, results of treatment of, 920, 922
 congenital diseases of, extrophy of bladder, 831
 loculate bladder, 831
 conventional divisions of air-distended, 808
 cysts of, pathology of, 906
 diseases of, alterations and displacements, 836
 congenital, 831
 cystitis, 858
 electrotherapy and, 989
 extrophy of bladder, 831
 fistula, 843
 foreign bodies, 838
 history of, 805, 830
 loculate bladder, 831
 pilimiction, 856
 tumors, 900
 displacements and alterations of, 836
 examination of, cystoscopy, 811
 inspection, 811
 instruments for, 813
 palpation, 809
 percussion, 809
 steps in, 816
 urinalysis, 809
 extension of cervical carcinoma to, 583
 extrophy of, 831
 fistula of, diagnosis of, 845
 etiology of, 843
 operative treatment of, 850
 symptomatology of, 844
 treatment of, 845, 850
 foreign bodies in, 838
 hernia of, repair of, 301, 305
 inflammation of, diagnosis of, 861
 etiology of, 859
 pathology of, 860
 prophylaxis and, 864
 symptomatology of, 861
 treatment of, 865
 various forms of, 860
 injuries of, operative treatment of, 398
 knee-chest position distending, 82
 loculate, 831
 myoma of, pathology of, 908
 myomectomy complicated by relations to, 561
 myxoma of, results of treatment of, 921, 922
 natural landmarks in, 806, 808, 830
 nerve supply of, 25
 normal position and relations of, 64, 308, 310
- Bladder, papilloma of, pathology of, 904
 results of treatment of, 919, 922
 postoperative irritability of, 412
 myomectomy and, 600
 relation to surrounding structures, 807
 sarcoma of, pathology of, 907
 results of treatment of, 921, 922
 topography of, divisions of, 808
 natural landmarks in bladder, 806, 830
 relation to surrounding structures, 807, 830
 tumors of, adenocarcinoma, 907
 adenoma, 906
 age incidence of, 903
 carcinoma, 906
 classification of, 901
 cysts, 906
 diagnosis of, 910
 etiology of, 903
 frequency of, 903
 history of, 901
 incidence of, 903
 myoma, 908
 papilloma, 904
 pathology of, 904
 radium and, 914, 922
 results of treatment of, 919, 922
 sarcoma, 907
 sex incidence of, 903
 symptoms of, 909
 treatment of, 912, 913
 x-ray treatment of, 918, 922
- Block, sacral, 430
- Blood, coagulation time of, determination of, 142
 dyscrasie of, uterine hemorrhage and, 142
 examination of, 95
 factors in coagulation of, 142
 protein therapy and reaction of, 923
- Blood-pressure, 402
- Blowing through the tubes, 169
- Bones and joints, neurological conditions of, backache and, 469
 pathological conditions in, arthritis, 467
 backache and, 464
 hypertrophic osteo-arthritis, 468
 infections, 467
 metastatic lesions, 468
 sacro-iliac tuberculosis, 467
 tuberculosis, 466
- Bonney's sustentaculum, 295
- Bowels, postoperative evacuation of, 412, 419

- Braces, lumbosacro-iliac, 460, 462
 Breast, carcinoma of, backache following
 metastasis of, 468
 Broad ligaments, histology of, 50
 Buboes, protein therapy and, 927
 Bulbed ureteral catheters, 894, 896, 898
 Bulbocavernosus muscle, anatomy of, 31,
 289
 Bullous edematous cystitis, 861

 Calcareous cystitis, 861
 Calcium, blood coagulation and, 142
 Calculi, bladder, 839
 ureteral, appendicitis differentiated
 from, 474, 475
 Calibrators, relaxed vaginal outlet meas-
 ured by, 273
 urethral, 815
 Carbon dioxid gas, peruterine tubal in-
 sufflation of, 172
 Carcinomata, backache following metas-
 tases of, 468
 cervical, benign uterine tumors and,
 504, 544
 cause of death from, 587
 classification of, 574
 conditions simulating, 592
 diagnosis of, 589
 duration of, 587
 electrotherapy and, 988
 etiology of, 574
 extension of, 580
 incidence of, 572
 metastasis of, 580
 myomectomy complicated by, 547
 pregnancy aggravating, 592
 prognosis of, 587
 pruritus vulvæ and, 229
 structure of, 575
 symptomatology of, 589
 treatment of, 593
 Wertheim operative technique in, 594
 x-ray treatment of, 962
 fundal, cause of death from, 603
 diagnosis of, 604
 duration of, 601
 extension of, 600
 incidence of, 600
 metastasis of, 600
 prognosis of, 601
 symptomatology, 604
 treatment of, 605
 x-ray treatment of, 963
 ovarian, 743, 773
 secondary, 748
 Carcinomata, papillary, fallopian, 790
 urethral, 828
 uterine, abdominal hysterectomy and,
 432
 hemorrhage and, 149
 vaginal hysterectomy and, 444
 vaginal, 385
 x-ray treatment of, 962
 vesical, pathology of, 906
 results of treatment of, 920
 vulvar, 206
 x-ray treatment of, 962
 vulvovaginal, 214
 Cardiac decompensation, protein therapy
 contra-indicated in, 928
 Cardinal ligament, 50, 294, 304, 309
 Caruncle, urethral, 827
 electrotherapy and, 989
 treatment of, 239, 989
 Caruncula myrtiformes, 38
 Castration, effects of, 125, 129
 Catarrhal cystitis, 860
 Catheters, bulbed ureteral, 894, 896, 898
 Pezzer, urinary incontinence and, 822
 Caudal anesthesia, 427
 Cecum, anatomy of, 11
 Cervicitis, chronic and cystic, electro-
 therapy and, 984
 traumatic, 253
 Cervico-abdominal fistula, hysterectomy
 followed by, extra-uterine preg-
 nancy and, 681
 Cervix uteri, carcinoma of, benign
 uterine tumors and, 504, 544
 cause of death from, 587
 classification of, 574
 conditions simulating, 592
 diagnosis of, 589
 duration of, 587
 electrotherapy and, 988
 etiology of, 574
 extension of, 580
 incidence of, 572
 metastasis of, 580
 myomectomy complicated by, 547
 pregnancy aggravating, 592
 prognosis of, 587
 structure of, 575
 symptomatology of, 589
 treatment of, 593
 vaginal hysterectomy and, 444
 Wertheim operative technique in,
 594
 x-ray treatment of, 962
 pruritus vulvæ and, 229
 childbirth injuries of, 243

- Cervix uteri, chronic inflammation of, 247
 congenital malformations of, 240
 diseases of, childbirth injuries, 243
 condyloma acuminatum, 254
 congenital malformations, 240
 erosion, 243
 gonorrheal endocervicitis, 252
 granuloma of, 254
 hypertrophied elongated cervix, 249
 inflammatory changes, 250
 lacerations, 243
 polyps, 260
 radium in, 942
 sarcoma, 261
 sterility and, 160
 syphilis, 255
 treatment of, 162
 traumatic cervicitis, 253
 tuberculosis, 256
 tumors, 260
 erosion of, 243
 gonorrhea of, 637
 granuloma of, 254
 hemorrhage from polyps of, 145
 histology of, 41
 inflammatory changes in, 250
 laceration of, repair of, 303
 treatment of, 245
 malformations of, 240
 normal position of, 310
 papilloma of, electrotherapy and, 987
 polyps of, 260
 rupture of, 100
 sarcoma of, 261, 608
 secretions of, significance of, 67
 stenosis of, sterility and, 160
 treatment of, 161
 syphilis of, 255
 tuberculosis of, 256
 tumors of, 260
- Chancroids, electrotherapy and, 985
 vulvar, 193
- Change of life, 124
- Childbirth, injuries to cervix during, 243
- Children, vesical tumors in, 909
- Children and young girls, gynecological examination of, 77
- Chlorosis, uterine hemorrhage and, 142
- Chocolate cysts, ovarian perforating hemorrhagic, 794
- Chorio-epitheliomata, diagnosis of, 616
 duration of, 615
 etiology of, 614
 extension of, 615
 fallopian, 792
 history of, 613
- Chorio-epitheliomata, lutein cysts and, 59
 structure of, 615
 symptomatology of, 615
 treatment of, 616
 tubal, extra-uterine pregnancy and, 709
 vaginal, 388
- Chronic appendicitis, gynecological conditions differentiated from, 475
 treatment of, 476
- Chronic cervicitis, electrotherapy and, 984
 treatment of, 247
- Chronic cystitis, treatment of, 865
- Chronic dysmenorrhea, 131
- Chronic gonorrheal salpingitis, symptomatology of, 651
 treatment of, 653
 operative, 655
- Chronic hypertrophic ulcerative vulvitis, 191, 199
- Chronic metritis, abdominal hysterectomy and, 432
- Chronic nephritis, miscarriage and, 167
- Chronic pelvic inflammatory disease, x-ray treatment of, 963
- Chronic salpingitis, appendicitis differentiated from, 475
 myomectomy complicated by, 567
- Chronic urethritis, treatment of, 824
- Clear space, 401
- Climacterium, 124, 1011
- Clip forceps, 593
- Clitoris, blood supply of, 29
 carcinoma of, 208
 diseases of, 216
 histology of, 37
 muscles of, 32
 new growths of, electrotherapy and, 985
- Cloaca, pelvic diaphragm and, 289
- Closure of incision, 408
- Coagulation time, determination of, 142
- Coccygeus muscle, anatomy of, 25, 31, 289
- Coccygodynia, neurological nature of, 469
- Colica scrotorum, 236
- Colles's fascia, anatomy of, 292
 importance of, 359
- Colpitis emphysematosa, 384
- Colporrhaphy, anterior, 314, 322
- Columnæ rugarum, 40
- Complete procidentia, modified Mayo operation for, 334
- Complete tear of rectovaginal septum, 269; old, 283
- Compulsion neurosis, 1006

- Concealed abscess, Skene's glands and, 825
 Concealed spina bifida, backache differentiated from, 457
 Condyloma acuminata, cervical, 254
 vulvar, 193
 Condylomata lata, gonorrheal infection and, 641
 vulvar, 192
 Congenital aspermia, 158
 Congenital malformations and developmental defects, 107, 112
 cervical, 240
 Connective-tissue tumors, ovarian, fibroma, 756
 papillary fibroma, 742
 sarcoma, 757
 Consent of patient, preoperative, 390
 Constipation, tuberculous salpingitis and, 667
 Constrictor urethræ muscle, anatomy of, 289, 292
 Constrictor vaginæ muscle, anatomy of, 31
 Coolidge hot-cathode tube, 957
 Coolidge water-cooled tube, 958
 Corpora albicantia, 59
 Corpus fibrosum, formation of, 124
 Corpus luteum, cyst of, 728
 development of, 122
 histology of, 57
 ovarian secretions and, 59
 ruptured, appendicitis differentiated from, 475
 Corpus luteum spurium, 123
 Corpus luteum verum, 123
 Corsets, lumbosacro-iliac, 460
 Cryptomenorrhea, 129
 Cullen's ectopic pregnancy sign, 696
 Cullen's uterine suspension, 485
 Curets, types of, 104
 Curettage, dilatation and, dangers of, 100
 general considerations of, 98
 indications for, 102
 macroscopic interpretation of endometrium, 104
 method of, 99, 103
 primary dysmenorrhea and, 137
 Cystadenomata, multilocular ovarian, 729, 768, 771
 Cystadenosarcoma, papillary ovarian, 746
 Cystic cervicitis, electrotherapy and, 984
 Cystic cystitis, 861
 Cystic fibromyxomata, fimbrial, 792
 Cystic myomata, uterine, 508
 Cystic rupture, ovarian tumors complicated by, 776
 Cystitis, diagnosis of, 861
 etiology of, 859
 pathology of, 860
 prophylaxis of, 864
 symptomatology of, 861
 treatment of, 865
 tuberculous, palpation of bladder and, 810
 various forms of, 860
 Cystocele, anatomical considerations of, 308
 history of, 305
 injuries resulting in, 312
 Mayo operation for, 334
 modified Watkin's repair of, 326
 myomatous uterus associated with, Far-
 rar operation for, 351
 prolapsus uteri and, 307
 relaxed vaginal outlet and, 271
 repair of, 301, 313, 323, 334, 351
 Cystomata, pseudomucinous, 734
 simple serous, 727
 Cystopexy, 314, 322
 Cystoscopy, cystitis diagnosis and, 863
 ureteral stricture and, 891
 Cystostomy, suprapubic extraperitoneal, vesical tumors and, 912
 transperitoneal, vesical tumors and, 913
 Cysts, chocolate, ovarian perforating hemorrhagic, 794
 corpus luteum, 728
 dermoid, ovarian, 750
 vesical, 856
 echinococcic, vaginal, 384
 epithelial inclusion, 380
 gas, vaginal, 384
 intraligamentary, graafian follicle and, 784
 operative management of, 781
 ovarian, abdominal hysterectomy and, 482
 appendicitis differentiated from, 475
 cystic papilloma, 740
 inflammatory, 767
 multilocular cystadenoma, 729
 pseudomucinous cystoma, 734
 simple retention, 727
 simple serous cystoma, 727
 sterility and, 161
 papillary parovarian, 765
 parovarian, age incidence of, 761
 diagnosis of, 763, 772
 extra-uterine pregnancy and, 651

- Cysts, parovarian, origin of, 760
 papillary, 765
 sterility and, 164
 symptoms of, 763
 tubo-ovarian, myomectomy complicated by, 567
 urethral, 830
 diagnosis of, 384
 vaginal, colpitis emphysematosa, 384
 epithelial inclusion cyst, 380
 echinococcic, 384
 embryonic epithelial structure cyst, 382
 gland cyst, 382
 treatment of, 384
 vesical, pathology of, 906
 vulvovaginal, 209
- Decidual reaction, tubal, extra-uterine pregnancy and, 675, 688
- Deciduoma malignum, etiology of, 614
 history of, 613
 treatment of, 616
- Deep superficial perineal fascia, anatomy of, 292
- Denudation, Hegar posterior median triangular, relaxed vaginal outlet and, 275
- Dermatitis, intertriginous, 188
- Dermoid cysts, ovarian, 750, 772
 vesical, 856
- Descensus uteri, ureteral stricture and, 888
- Desormeaux's probe, 817
- Developmental defects, congenital malformations and, 107, 112
- Developmental inhibitions, 112
- Diabetes, amenorrhea and, 129
 miscarriage and, 167
 protein therapy contra-indicated in, 928
 vaginal hysterectomy and, 444
- Diabetic vulvitis, 189
- Diagnostic aids, basal metabolism, 96
 blood examination, 95
 microscopy, 97
 urinalysis, 93
- Diaphragm, pelvic, anatomy of, 290
 upper pelvic, anatomy of, 294
 importance of, 296
 urogenital, anatomy of, 291
- Diarrhea, tuberculous salpingitis and, 667
- Diathermy, protein therapy and, 926
- Diet, postoperative, 411
 sterility and, 166
- Dilatation and curettage, dangers of, 100,
 general considerations of, 98
 indications for, 102
 macroscopic interpretation of endometrium, 104
 method of, 99
 office, 103
 primary dysmenorrhea and, 137
- Dilators, Goodell-Ellinger, 103
 Hegar, 100, 814
 dysmenorrhea and, 137
 sterility and, 162
 urethral, 813
- Diphtheritic vaginitis, 223
- Displacements, bladder, 836
 urethral, 820
- Distention, bladder, air or water, 869, 894
- Diverticula, urethral, 824
- Döderlein's bacillus, 40
- Donovan bodies, granuloma inguinale and, 197
- Dorsal posture, inspection in, 65
- Douglas's hernia, repair of, 302, 347, 371, 374
- Doyen's vaginal hysterectomy, 453
- Drainage, abdominal hysterectomy and, 443
 cystitis treatment by, 871
 general principles of, 406
 pelvic abscess and, 629
 vaginal hysterectomy and, 453
- Dressing, abdominal, 409
- Dysmenorrhea, benign uterine tumors and, 498
 chronic, 131
 electrotherapy and, 992
 endocrinology and, 154
 etiology of, 132
 history of, 131
 hypoplastic, organotherapy and, 156
 membranous, 138
 nasal, 138
 primary, etiology of, 132
 treatment of, 137
 radium in, 953
 secondary, etiology of, 134
 treatment of, 137
 treatment of, 135
 ureteral stricture and, 884
 x-ray treatment of, 961
- Dyspareunia, defense mechanism of, 1010
 diagnosis of, 237
 etiology of, 235
 examination in, 237
 imperforate hymen and, 114
 inflammatory, 236

- Dyspareunia, mechanical, 235
 psychic, 235
 sterility and, 161
 treatment of, 237
 ureteral stricture and, 888
- Dystocia, sterility and, 159
- Dystrophy adipogenitalis, amenorrhea and, 152
 etiology of, 114, 150
- Dystrophia adipogenitalis, organotherapy and, 155
- Echinococcic cysts, vaginal, 284
- Ectopic endometriomata, benign, treatment of, 801
- Ectopic pregnancy, chorioepithelioma of tube and, 709
 classification of, 682
 clinical history of, 688
 Cullen's sign in, 695
 definition of, 673
 diagnosis of, 697
 etiology of, 674
 fetal abnormality and, 717
 mortality of, 720
 myomectomy complicated by, 560
 prognosis of, 708
 repeated, 711
 rudimentary uterine horn, 721
 ruptured, appendicitis differentiated from, 474
 symptoms of, 692
 treatment of, 712, 716
 x-ray diagnosis of, 698
- Eczema, pruritus vulvae and, 230
- Edema, vulvar, 191, 197
- Edematous cystitis, 861
- Edocrinology, functional uterine bleeding and, 153
- Effluvium seminis, sterility caused by, 159
 treatment of, 161
- Electrotherapy, diseases treated by, 982
 carcinoma of cervix, 988
 chancre, 985
 chronic and cystic cervicitis, 984
 dysmenorrhea, 992
 endocervicitis, 984
 infections, 982
 new growths, 985
 papilloma of cervix, 987
 pruritus, 985
 urethral, 989
 urethritis, 983
 urinary tract, 992
- Electrotherapy, diseases treated by, 982
 venereal warts, 985
 verruca acuminata, 985
 vulvovaginitis, 984
 general considerations of, 974
 vesical, 989
 currents, 975
 histology, 981
 technique, 975
 operations conducted with, 993
- Elephantiasis, labia minora and, 215
 vulval, 200
- Elongated cervix, hypertrophied, treatment of, 219
- Emboli, cervical carcinoma terminating in death from, 587
 preoperative, 425
- Embryomata, ovarian, 749
 dermoid cyst, 759
 teratoma, 756
- Embryonic epithelial structure cyst, 382
- Empysematous vaginitis, 225
- Endocervicitis, electrotherapy and, 984
 gonorrheal, mercurochrome in, 252
 incidence of, 250
 tuberculous, 259
- Endocrinology, amenorrhea and, 152
 dysmenorrhea and, 151
 sterility and, 151
- Endometrial implants, 798
 malignant, 803
- Endometrial carcinomata, symptoms of, 812
- Endometriomata, benign ectopic, etiology of, 791
 pathology of, 791
 symptomatology of, 793
 treatment, 801
- Endometriosis, inguinal, 800
- Endometrium, blood supply of, 18
 histology of, 42, 119
 internal phase, 45, 120
 menstrual phase, 46, 120
 postmenstrual phase, 47, 119
 pregnant phase, 48
 premenstrual phase, 45, 120
 hyperplastic, uterine hemorrhage from, 144
 lesions of, treatment of sterility caused by, 163
 tuberculous, hemorrhage from, 145
 myomectomy complicated by, 556
 tuberculous salpingitis and, 662
- Endopelvic fascia, visceral layer of, anatomy of, 290
- Endotheliomata, uterine, 608

- Endothermy, cystitis treatment by, 871
 surgical, vesical tumors and, 913
- Enterocoele, repair of, 302, 347, 371, 374
- Enterovesical fistulas, operative treatment of, 855
- Enucleator, myoma, 527
- Enuresis, cause of, 890
- Epithelial inclusion cysts, 380
- Epithelial structure cyst, embryonic, 382
- Epithelial tumors, benign ovarian, 727
 multilocular cystadenoma, 729
 papillary tumors, 738
 pseudomucinous cystoma, 734
 simple serous cystoma, 727
- malignant ovarian, adenocarcinoma, 743
 carcinoma, 743
 Krukenburg tumor, 748
 mixed types of, 749
 papillary adenocarcinoma, 745
 papillary cystadenosarcoma, 746
 secondary carcinoma, 748
- Epitheliomata, chorio-, diagnosis of, 616
 duration of, 615
 etiology of, 614
 extension of, 615
 extra-uterine pregnancy and, 709
 fallopian, 792
 history of, 613
 lutein cysts and, 59
 structure of, 615
 symptomatology of, 615
 treatment of, 616
 vaginal, 388
- Esthiomene, 199
- Ether anesthesia, examination under, 84
- Eversion, bladder, 831
- Examination, bladder and urethra, cystoscopy and urethroscopy, 811
 inspection, 811
 instruments for, 813
 palpation, 809
 percussion, 809
 steps in, 816
 urinalysis, 809
- gynecological, abdominal organs, 84
 abdominal walls and rectum, 72
 anesthesia and, 83
 anterior surface uterus through rectum, 74
 bimanual, 67
 children and young girls, 77
 digital, 66
 dorsal posture, 65
 fallopian tubes, 71
 general considerations, 60
- Examination, gynecological, history taking, 61
 hymen, 65
 inspection, 65
 invagination of pelvic floor, 70
 knee-chest posture, 76
 outlet, 65
 ovaries, 71
 preoperative, 391
 pulled-down uterus, 74
 rectum, 78
 rectum and abdominal walls, 72
 retroposed uterus, 73
 seat of pain, 83
 Sims posture, 75
 uterine sound diagnosis, 74
 uterine tubes, 71
 uterus, 70, 71
 vulva, 65
- Exfoliative cystitis, 860
- Exfoliative vaginitis, 223
- Exophthalmic goiter, organotherapy and, 156
- Exposure of field, 396
- External genitalia, histology of, 36
- External oblique muscle, anatomy of, 5
- External superficial perineal tear, 267
- Extraperitoneal cystostomy, suprapubic, vesical tumors and, 912
- Extra-uterine pregnancy, chorio-epithelioma of tube and, 709
 classification of, 682
 clinical history of, 688
 Cullen's sign in, 696
 definition of, 673
 diagnosis of, 692
 etiology of, 674
 fetal abnormality and, 712
 hemorrhage from, 150
 mortality of, 720
 myomectomy complicated by, 560
 prognosis of, 708
 repeated, 711
 ruptured, appendicitis differentiated from, 474
 symptoms of, 692
 treatment of, 712, 716
 x-ray diagnosis of, 698
- Extrophy, bladder, 831
- Facial expression, postoperative, 414
- Fallopian tubes, anatomy of, 11
 atresia of, ectopic pregnancy and, 677
 bimanual examination of, 71

- Fallopian tubes, decidual reaction in, extra-uterine pregnancy due to, 675
 diseases of, appendicitis and, 471
 myomectomy complicated by, 567
 x-ray treatment of, 964
 diverticula from lumen of, extra-uterine pregnancy and, 679
 ectopic pregnancy due to accessory ostia of, 680
 extension of cervical carcinoma to, 581
 extra-uterine pregnancy and chorio-epithelioma of, 709
 extra-uterine pregnancy due to persistence of fetal type of, 678
 gonorrheal infection of, 642, 650
 acute stage of, 650
 chronic stage of, 651
 hematocoles in, significance of, 707
 histology of, 51
 inflammatory affections of, extra-uterine pregnancy and, 680
 occlusion of, sterility and, 160
 treatment of sterility caused by, 164
 peristalsis in, 176
 peruterine insufflation to determine patency of, 169
 polyps of, extra-uterine pregnancy and, 677
 rudimentary, myomectomy complicated by, 567
 tuberculosis of, 661
 tumors of, 789
 Farrar operation for large cystocele associated with myomatous uterus, 351
 Fascia and ligaments of pelvic floor, anatomy of, 289, 358
 injuries to, 298, 358
 Fascia infradiaphragmatica, 290
 Fascia supradiaphragmatica, 290
 Fascia transversalis, anatomy of, 5
 Fat, abdominal signs of, 89
 Feminine pseudohermaphroditism, 112
 Femoral ring, anatomy of, 27
 Fergusson traction forceps, 100, 399
 Fetal abnormality, extra-uterine pregnancy and, 712
 Fever, acute rheumatic, sterility and, 159
 Fibrinogen, blood coagulation and, 142
 Fibrocystic tumors, uterine, 508
 Fibroid tumors, uterine, characteristics of, 496
 diagnosis of, 515
 form peculiarities of, 514
 Fibroid tumors, uterine, hemorrhage and, 148
 incidence of, 498
 malignancy of, 149
 organotherapy and, 156
 radium in, 948
 site of, 504
 symptomatology of, 498
 treatment of, 518
 Fibroid tumors, uterine, x-ray treatment of, 521, 961
 Fibromata, fallopian, 792
 ovarian, connective-tissue character of, 756
 papillary, 742
 submucous, uterine hemorrhage from, 147
 urethral, 829
 vesical, 909
 vulvar, 203
 Fibromyomata, blood supply of, 18
 menorrhagia and, 19
 uterine, characteristics of, 496
 diagnosis of, 515
 form peculiarities of, 514
 incidence of, 498
 site of, 504
 symptomatology of, 498
 treatment of, 518
 x-ray treatment of, 521
 vulvar, 203
 Fibrosarcoma mucocellulare carcinomatodes, Krukenburg's, 748
 Fifth lumbar sacralization, backache and, 458, 460
 Fimbriatubo-ovarica, 52
 First sacral vertebra, incomplete fusion of, backache and, 459
 Fistulas, enterovesical, operative treatment of, 855
 infected, electrotherapy and, 985
 posthysterectomy cervico-abdominal, extra-uterine pregnancy and, 681
 vesical, diagnosis of, 845
 rectopelvivaginal, pelvic abscess complicated by, 632
 etiology of, 843
 operative treatment of, 850
 symptomatology, 844
 treatment of, 845, 850
 vesico-uterine, operative treatment of, 854
 vesico-utero vaginal, operative treatment of, 854
 vesicovaginal, operative treatment of, 850

- Focal infections, backache and, 467
 enuresis and, 890
 ureteral stricture and, 875
 uterine hemorrhage and, 143
 Follicle, graafian, intraligamentary cysts and, 784
 Follicular atresia, 124
 Food, postoperative, 411
 Forceps, alligator, 816
 Allis, 279
 clip, 593
 Fergusson traction, 100, 399
 Jacobs, 148, 326
 Kocher-Ochsner, 400
 museau, 437
 polyp, 100, 102
 types of, 400
 Foreign bodies, bladder, 838
 Fowler's method of drainage, 408
 Fractures, backache and, 464
 Fröhlich's syndrome, amenorrhea and, 130, 152
 Functional uterine bleeding, endocrinology and, 153
 organotherapy and, 156
 Fundus uteri, carcinoma of, diagnosis of, 604
 duration of, 601
 cause of death from, 603
 extension of, 600
 incidence of, 600
 metastasis of, 600
 prognosis of, 601
 symptomatology of, 604
 treatment of, 605
 x-ray treatment of, 963
 diseases of, radium in, 944
 displacements of, treatment of, 162
 extension of cervical carcinoma to, 581
 gonorrheal infection of, 642
 histology of, 42
 sarcoma of, 609
 tuberculous salpingitis and, 662
 Furunculosis, vulvar, 188
 Fusion, fifth lumbar, backache and, 458
 first sacral, incomplete, backache and, 459
 labial, 108, 114
 Gartner's duct, cyst of, 382
 histology of, 50
 relations to pelvic viscera
 Gas cysts, vaginal, 384
 Gas insufflation in sterility, 169
 Gas tube, 956
 Gatch frame, 408
 Gebhart's subepithelial hematomata, 46
 Gehrung pessary, 489, 494
 Genital infantilism, 114
 Genital spots, dysmenorrhea and, 138
 Genital tuberculosis, protein therapy and, 927
 Genitalia, external, histology of, 36
 internal, histology of, 38
 Germinal epithelium, histology of, 54
 Glass ball pessaries, 490
 Gland cysts, vaginal, 382
 Globular myomata, myomeotomy complicated by, 541
 Glucose-gum acacia apparatus, 403, 415
 Glycosuria, pruritus vulvæ and, 229
 Goiter, exophthalmic, organotherapy and, 156
 Gonorrhea, gonorrhea in children, clinical course of, 648
 contagiousness of, 647
 pathology of, 647
 prognosis of, 649
 treatment of, 648
 gonorrhea in women, 634
 bacteriology of, 636
 pathology of, 636
 incidence of, 635
 site of, 637
 treatment of, 638
 Gonorrheal Bartholinitis, edema in, 191
 electrotherapy and, 984
 protein therapy in, 927
 Gonorrheal endocervicitis, mercurochrome in, 252
 Gonorrheal salpingitis, acute stage of, 650
 appendicitis differentiated from, 472
 chronic stage of, 651
 extra-uterine pregnancy and, 680
 incidence of, 642, 650
 pelvic abscess and, 625
 Gonorrheal urethritis, electrotherapy and, 983
 Gonorrheal vaginitis, leukorrhea in, 222
 Gonorrheal vulvovaginitis, electrotherapy and, 984
 Goodell bivalve speculum, use of, 66
 Goodell-Ellinger dilator, 103, 162
 Graafian follicle, histology of, 54
 intraligamentary cysts of, 784
 Graafian follicle hematoma, appendicitis differentiated from, 475
 Granuloma inguinale, 197

- Granulomata, cervical, 254
 urethral, electrotherapy and, 989
 treatment of, 239
- Graves' syndrome, organotherapy and, 156
- Gum acacia glucose apparatus, 403
- Gummata, vulvar, 192
- Health of surgeon, 390
- Heart disease, miscarriage and, 167
- Hegar's dilators, dysmenorrhea and, 137
 sterility and, 162
 urethral examination and, 814
 use of, 100
- Hegar's posterior median triangular denudation, relaxed vaginal outlet and, 275
- Hegar's sign, histological basis for, 41
- Hematocolpos, imperforate hymen causing, 114
- Hematomata, Gebhart's subepithelial, 46
 graaian follicle, appendicitis differentiated from, 475
 vulvar, 189
- Hematometra, cervical disease and, 264
- Hematosalpinx, myomectomy complicated by, 567
- Hematuria, vesical tumors and, 910
- Hemorrhage, carcinoma indicated by, 589, 604
 death following carcinoma and, 587, 603
 extra-uterine pregnancy and, 703
 functional uterine, endocrinology and, 153
 hymeneal, 218
 intestinal, postoperative, 426
 operative, control of, 400
 pelvic abscess complicated by, 632
 sarcoma of uterus and, 612
 secondary, control of, 416
 ureteral stricture and, 890
 uterine, benign tumors and, 501
 etiology, 141
 radium in, 951
 treatment, 151
 x-ray treatment of, 960
- Hemorrhagic (chocolate) cysts, ovarian perforating, 794
- Henke's fissure, anatomy of, 9
- Henle's ligament, anatomy of, 16, 50
- Hermaphroditism, types of, 108
- Hernia, bladder, repair of, 301, 305
 Douglas's, repair of, 302, 371, 374
 inguinal, vulvar manifestation of, 204
- Hernia, rectal, repair of, 302, 359
- Hesselbach's triangle, anatomy of, 26
- High rectocele, repair of, 302
- Hodge's pessary, 489
- Horizontal bisection, abdominal hysterectomy by, 441
- Hormone, ovarian, 59
 amenorrhea and, 153
 organotherapy and, 156
- Hottentot apron, 65
- Hunner's vaginal hysterectomy, 453
- Hydatid, Morgagni's, 766
 histology of, 50
- Hydatidiform mole, lutein cysts and, 59
- Hydrocele muliebris, 203
- Hydronephrosis, benign uterine tumors and, 503
 miscarriage and, 167
- Hydrosalpinx, benign uterine tumors and, 502
 myomectomy complicated by, 567
- Hydro-ureter, benign uterine tumors and, 503
 cervical carcinoma and, 587
- Hymen, atresia of, 219
 diseases of, 218
 histology of, 38
 imperforate, 114, 129
 injuries of, 218
 inspection of, 65
 ruptured, hemorrhage from, 144
 tumors of, 221
- Hymenectomy, 114
- Hyperemic cystitis, 860
- Hyperthyroidism, amenorrhea and, 130
 organotherapy and, 156
- Hypertrophic ulcerative vulvitis, chronic, 191, 199
- Hypertrophied elongated cervix, treatment of, 249
- Hypernephromata, backache following metastasis of, 468
- Hyperplastic endometrium, uterine hemorrhage from, 144
- Hypertrophic osteo-arthritis, backache and, 468
- Hypodermoclysis, novocain and, 415
- Hypopituitarism, amenorrhea and, 152
 dystrophy adiposogenitalis and, 114, 130
- Hypoplasia, dysmenorrhea and, 133
- Hypothyroidism, functional uterine bleeding and, 154
- Hysterectomy, abdominal, closure of wound in, 443
 drainage in, 443

- Hysterectomy, abdominal, extirpation by continuous incision from side to side, 434
 horizontal bisection and, 441
 indications for, 432
 methods of, 433, 436
 sagittal bisection and, 437
 vaginal, Doyen's, 453
 Hunner's, 453
 indications for, 444
 technique of, 445
- Hysteromyomectomy, history of, 529
 indications for, 524, 530
 technique of, 530
- Hysterosalpingo-oöphorectomy, indications for, 432
- Ileococcygeus muscle, anatomy of, 290
- Ileus, postoperative, 421
- Imperforate hymen, 114, 129
- Impinging spinous processes of lower lumbar vertebra, backache and, 459
- Implants, endometrial, 798
 malignant, 803
 ovarian, 798
- Incisions, affections of, 409
 closure of, 408
 exploratory, 395
 fat women and, 395
 length of, 394
 tubo-ovarian abscess, 396
- Inclusion cysts, epithelial, 380
- Incontinence, urinary, 821
 ureteral stricture and, 890
- Infantile pelvis, anatomy of, 2
- Infantile rectum, position of, 3
- Infantile uterus, dysmenorrhea and, 133
 position of, 3
- Infantile vagina, position of, 3
- Infantilism, 1005
 genital, 114
- Infection, carcinoma terminating in death from, 587, 603
 extravescical foci of, elimination of, 867
 focal, backache and, 467
 enuresis and, 890
 ureteral stricture and, 875
 uterine hemorrhage and, 143
 gonorrheal, electrotherapy and, 982
 myomectomy complicated by, 549
 pelvic, protein therapy in, 926
 postpartum or postabortal, appendicitis differentiated from, 474
- Infection, puerperal, pelvic abscess and, 625
 protein therapy in, 925
 submucous tumors and, 501
- Infectious diseases, acute, amenorrhea and, 129
- Inflammatory ovarian cysts, 767
- Influenza, amenorrhea and, 129
- Infundibulopelvic ligament, anatomy of, 16, 50
- Inguinal endometriosis, 800
- Inguinal granulomata, 194
- Inguinal hernia, vulvar manifestation of, 204
- Inguinal ring, anatomy of, 27
- Inhibitions, developmental, 112
- Injuries, bladder, operative treatment of, 398
 cervical, childbirth causing, 243
 cystocele resulting from, 312
 hymeneal, 218
 pelvic fascia and ligament, 298
 pelvic floor, general considerations of, 298, 358
 puerperal, carcinoma and, 574
 ureteral, 398
 vulval, 189
- Insanity, amenorrhea and, 130
 menopause and, 127, 1011
- Instillations, bladder, 868
- Insufflation in sterility, peruterine tubal, 169
- Intermenstrual pain, 138
- Internal genitalia, histology of, 38
- Internal oblique muscle, anatomy of, 5
- Internal perineal tear, 267
- Internal secretions, amenorrhea and, 152
 dysmenorrhea and, 154
 functional uterine bleeding and, 153
 sterility and, 154
- Interstitial oöphoritis, benign uterine tumors and, 502
- Interstitial pregnancy, criteria of, 685
 treatment of, 719
- Intertrigenous dermatitis, 188
- Interureteric ligament, 807
- Intestinal hemorrhage, postoperative, 426
- Intestinal obstruction, cervical carcinoma terminating in death from, 587
- Intestine, large, anatomy of, 10
 small, anatomy of, 6
 groups of, 6, 9
 length of, 9
- Intraligamentary cysts, graafian follicle and, 784
 operative management of, 781

- Intra-uterine pregnancy, myomectomy complicated by, 556
- Intra-uterine tuberculosis, 662
- Involution melancholia, 1011
- Irrigations, bladder, 868
- Ischiocavernosus muscle, anatomy of, 289
- Ischiorectal fossa, anatomy of, 33
- Ischuria, diagnosis and treatment of, 823
- Jacobs forceps, 148, 326
- Joints and bones, neurological conditions of backache and, 469
- pathological conditions in, arthritis, 467
- backache and, 464
- hypertrophic osteo-arthritis, 468
- infections, 467
- metastatic lesions, 468
- sacro-iliac tuberculosis, 467
- tuberculosis of, 466
- Kelly endoscope, 894
- Kelly uterine suspension, 483
- Kidney, displacement of, palpation of, 92
- Knee-chest posture, 76, 82
- Kocher-Ochsner forceps, 400
- Koch's cardinal ligament, 50, 294, 304, 309
- Kolpohyperplasia cystica, 225
- Kossmann's appendix vesicularis, 766
- Kraurosis vulvæ, pruritus and, 230
- Kriegs amenorrhæ, 129
- Krukenburg ovarian tumor, 748
- Kymographic studies, peruterine tubal insufflation and, 176, 181
- Labat sacral anesthesia, 429
- Labia majora, fibroma of, 205
- fusion (agglutination) of, 108, 114
- histology of, 36
- varicose veins of, 190
- Labia minora, diseases of, 215
- histology of, 37
- Labor, premature, syphilis and, 167
- Lacerations, cervical, carcinoma resembling, 592
- childbirth and, 243
- repair of, 303
- treatment of, 245
- perineal, complete tear of rectovaginal septum, 269
- external superficial tear, 267
- Lacerations, perineal, internal tear, 267
- old complete tear, 283
- recent injuries classified, 267
- relaxed vaginal outlet, 271
- repair of, 303
- supports of vaginal outlet, 265
- Lactation, amenorrhea during, 129
- Laminaria, use of, 99
- Large intestine, anatomy of, 10
- Length of incision and how to find peritoneum, 394
- Leukoderma vulvæ, 189
- Leukoplakic cystitis, 861
- Leukorrhea, cervical carcinoma and, 589
- diagnosis of, 223
- etiology of, 222
- prophylaxis of, 224
- sarcoma of uterus and, 612
- treatment of, 225
- tuberculous salpingitis and, 668
- Levator ani muscle, anatomy of, 27, 31, 289
- Ligamenta colli transversa, Mackenrodt's, 294
- Ligaments, broad, histology of, 50
- cardinal, 50, 294, 304, 309
- Henle's suspensory, anatomy of, 50
- infundibulopelvic, anatomy of, 16, 50
- interureteric, 807
- Koch's cardinal, 50, 294, 304, 309
- ovarian, anatomy of, 16
- Poupart's, anatomy of, 5, 25
- round, histology of, 50
- triangular, anatomy of, 291
- uterine, histology of, 50
- uterosacral, anatomy of, 13, 295
- histology of, 51
- Ligation of pedicle, 399
- Linea alba, anatomy of, 5, 33
- Lipectomy, 395
- Lipomata, vulval, 202
- Lipomyoma, uterine, 498
- Liquor folliculi, ovarian secretions and, 59
- Lithotomy posture, 65
- Littre's acinous glands, urethral inspection and, 812
- Lochiometra, protein therapy and, 928
- Loculate bladder, 831
- Lumbosacral strains, backache and, 457, 460
- Lung, diseases of, miscarriage and, 167
- Lupus, 199
- Lutein cells, origin of, 59
- Lymphangioma, vulval, 191
- Lymphatics, pelvic, 20
- extension of cervical carcinoma to, 586

- Mackenrodt's ligamenta colli transversa, 294
- Malaplastic cystitis, 861
- Malformations, congenital, cervical, 240
developmental defects and, 107
- Malignant implants, endometrial type of, 803
- Malignant ovarian epithelial tumors, 743
adenocarcinoma, 743
carcinoma, 743
Krukenburg tumor, 748
mixed types of, 749
papillary adenocarcinoma, 745
papillary carcinoma, 745
papillary cystadenosarcoma, 746
secondary carcinoma, 748
- Malignant tumors, uterine, adenomyoma, 618, 622
carcinoma of body of uterus, 600
carcinoma of cervix, 572
chorio-epithelioma, 613
sarcoma, 607
vaginal, carcinoma, 385
chorio-epithelioma, 388
sarcoma, 387
vulvar, 206
- Martin's retinaculum uteri, 295
- Masculine pseudohermaphroditism, 110
- Masturbation, 1002
pruritus vulvæ and, 230
- Mayo operation for complete procidentia, modified, 334
- McCarthy endoscope, 894
- Medullary cords, origin of, 59
- Melancholia, amenorrhea and, 130
menopause and, 1011
- Membranous dysmenorrhea, 138
- Menarche, hemorrhages during, 142
- Menge pessary, 492, 495
- Meningitis, chronic spinal, backache and, 469
- Menopause, nervous and psychic symptoms following, 127
nervous instabilities and, 1011
premature, 124
surgical, 125
symptoms of, 126
treatment of, 156
time of, 124
treatment of symptoms of, 128
uterine hemorrhage during, 142
vasomotor symptoms during, organo-therapy and, 156
- Menorrhagia, benign uterine tumors and, 501
endocrinology and, 153
- Menorrhagia, etiology of, 141
fibromyoma and, 19
radium in, 951
treatment of, 151
ureteral stricture and, 890
x-ray treatment of, 960
- Menotoxin, 118
- Menstrual functioning and mental health, 1004
- Menstruation, age and, 119
amount of blood lost during, 118
anatomic changes during, 119
cessation of, extra-uterine pregnancy and, 692
clinical characteristics of, 118
discharge of, character of, 118
disturbances of, tuberculous salpingitis and, 668
duration of, 118
effect of peruterine tubal insufflation upon, 182
endometrial changes in, 120
historical, 117
menopause and, 124
menotoxin and, 118
metabolic wave of, 118
molimina of, 118
painful, 131
benign uterine tumors and, 498
periodicity of, 118
physiological basis of, 43
puberty and, 119
rhcxis, 47
toxemia and, 118
uterine blood supply during, 18
vaginal reaction to, 40
venous character of blood of, 20
- Mesentery, anatomy of, 6
- Mesometrium, 294
- Metabolism, basal, value of determination of, 97
protein therapy and, 924
- Metastasis, carcinoma and, 580, 600
chorio-epithelioma and, 615
- Metritis, chronic, abdominal hysterectomy and, 432
- Metrorrhagia, radium in, 951
- Microscopy, value of, 97
- Migration of ovum, ectopic pregnancy and, 678
- Milk (protein) therapy, adjuvants to, 926
contra-indications to, 928
initial dose, 925
interval between injections, 925
outward signs of, 924

- Milk (protein) therapy, propitious time for administration of, 924
 site of injection, 925
 substances used in, 924
 technique of, 925
 theory of, 923
- Miscarriage, causes of, 167
 sterility caused by, 167
- Mittel-schmerz, 138
- Modified Watkin's operation, cystocele repair and, 326
- Mole, hydatidiform, lutein cysts and, 59
- Mons ureteris, 806, 819
- Mons veneris, histology of, 36
- Morgagni's hydatid, histology of, 50, 766
- Morgagni's urethral glands, 812
- Müllerian ducts, hymen originating from, 38
 result of failure of fusion of, 383
- Müllerian union, inhibition of, 112
- Multilocular ovarian cystadenomata, 729, 768, 771
- Multiple pregnancy, extra-uterine pregnancy and, 709
- Mumps, sterility and, 159
- Mundé-Thomas-Smith pessary, 489
- Muscles, abdominal, anatomy of, 4
 pelvic, anatomy of, 24
 pelvic floor, anatomy of, 289
- Musculotendinous spot, anatomy of, 290
- Museau forceps, 437
- Myoma enucleator, 527
- Myomata, globular, myomectomy complicated by, 541
 parasitic, 512
 spinal backache from, 468
 submucous, carcinoma resembling, 592
 suppurating, myomectomy complicated by, 549
 uterine, abdominal hysterectomy and, 432
 characteristics of, 496
 diagnosis of, 515
 extra-uterine pregnancy and, 681
 Farrar operation for large cystocele associated with, 351
 form peculiarities of, 514
 incidence of, 498
 site of, 504
 sterility and, 161
 symptomatology of, 498
 treatment of, 163, 518
 x-ray treatment of, 521
- vaginal, 385
- vesical, pathology of, 908
 results of treatment of, 922
- Myomectomy, complications of, 541
 environmental, 560
 indications for, 521, 523
 technique of, 525
 Wertheim, 594
- Myometrium, blood supply of, 18
- Myopathia uterina, 141
- Myxomata, vesical, 909
 results of treatment of, 921
- Nabothian follicles, histology of, 42
- Nasal dysmenorrhea, 138
- Nausea, postoperative, 411, 417
- Necrospermia, sterility and, 158
- Needle holder, 399
- Nelson trivalve speculum, use of, 66
- Nephritis, amenorrhea and, 129
 chronic, miscarriage and, 167
- Nephroptosis, palpation of, 92
- Nervous instabilities, menopausal, 1011
- Neuralgia, ovarian, ureteral stricture and, 886
- Neurasthenia, history of, 1006
- Neuroses, backache and, 469
 basal metabolism and, 97
 behavior anomalies and, 1006
 dysmenorrhea and, 131, 133
 dyspareunia and, 235
 menopause and, 127
 sacral anesthesia and, 428
- New growths, cervical, 260
 dysmenorrhea and, 135
 electrotherapy and, 985
 hymeneal, 221
 ovarian, benign epithelial tumors, 727
 connective-tissue tumors, 756
 embryoma, 749
 malignant epithelial tumors, 743
- tubal, 789
- urethral, 826
- vaginal, 380
- vesical, adenocarcinoma, 907
 adenoma, 906
 carcinoma, 906
 cysts, 906
 myoma, 908
 outline of, 900
 papilloma, 904
 sarcoma, 907
- Nitrous oxid-oxygen anesthesia, examination under, 84
- Nitze cystoscope, ureteral stricture and, 894, 897
- Nymphæ, histology, 37

- Obesity, hypogenital, organotherapy and, 156
- Obturator muscle, anatomy of, 24
- Ochsner-Kocher forceps, 400
- Oidium albicans, pruritus vulvæ and, 229
- Old complete perineal tear, 283
- Onkophobia, 530
- Oöphoritis, interstitial, benign uterine tumors and, 502
- tuberculous, x-ray treatment of, 964
- Oöphorrhaphy, 487
- Organotherapy, dysmenorrhea and status of, 154
- dysmenorrhea from genital hypoplasia and, 156
- functional amenorrhea and, 155
- functional uterine hemorrhage and, 156
- hypogenital obesity and, 156
- progress in, 155
- sterility and, 156
- Osteo-arthritis, hypertrophic, backache and, 468
- Osteomalacia, backache and, 469
- Outlet, vaginal, inspection of, 65
- Ovarian implants, 798
- Ovarian pregnancy, criteria of, 685
- Ovaries, adenocarcinoma of, 743
- anatomy of, 11
- angiosarcoma of, 758
- anomalies of, sterility and, 160
- treatment of, 165
- bimanual examination of, 71
- blood supply of, 13, 16
- carcinoma of, 743
- connective-tissue tumors of, 756
- cysts of, abdominal hysterectomy and, 432
- appendicitis differentiated from, 475
- simple ovarian, 727
- sterility and, 161
- dermoid cyst of, 750, 772
- diseases of, appendicitis and, 471
- myomectomy complicated by, 567
- radium in, 946
- x-ray treatment of, 964
- embryoma of, 749
- endometriomata of, etiology of, 794
- pathology of, 794
- treatment of, 801
- fibroma of, 756
- histology of, 53
- hormones of, amenorrhea and, 153
- hydatid of Morgagni and, 766
- Krukenburg tumor of, 748
- ligaments of, anatomy of, 16
- lymphatics of, 20
- Ovaries, menstrual cycle and changes in, 121
- multilocular cystadenoma of, 729, 768, 771
- neuralgia of, ureteral stricture and, 886
- new growths of, benign epithelial tumors, 727
- connective-tissue tumors, 756
- embryoma, 749
- malignant epithelial tumors, 743
- organotherapy and, 156
- papillary adenocarcinoma of, 745
- papillary cystadenosarcoma of, 746
- papillary tumors of, 738, 772
- prolapse of, suspension of, 486
- pseudomucinous cystoma of, 734
- sarcoma of, age incidence of, 758
- characteristics of, 759
- connective-tissue origin of, 757
- gross appearance of, 758
- metastasis of, 759
- varieties of, 757
- secondary carcinoma of, 748
- secretions of, 59
- simple serous cystoma of, 727
- teratoma of, 756
- tumors of, adhesions complicating, 779
- benign epithelial, 727
- classification of, 725
- clinical course of, 767
- complications of, 773, 786
- connective-tissue, 756
- cystic rupture of, 776
- dermoid cyst, 750
- diagnosis of, 769
- embryoma, 749
- endometrial hematoma of ovary, 793
- fibroma, 756
- hydatid of Morgagni, 766
- inflammatory cysts, 767
- intraligamentary cysts and, 781
- Krukenburg tumor, 748
- malignant epithelial, 743
- mixed types of, 749
- new growths, 727
- operative treatment of, 778
- papillary, 738
- parovarian cyst, 760
- radium and, 788
- relative incidence of, 726
- rotation of pedicle of, 773
- sarcoma, 757
- secondary carcinoma, 748
- simple retention cysts, 727
- sterility and, 161

- Ovaries, tumors of, teratoma, 756
 treatment of, 776
 x-ray and, 788
 x-ray treatment of, 963
- Ovulation, changes in ovary during, 121
- Ovum, migration of, extra-uterine pregnancy and, 678
- Paget's disease, backache and, 469
- Pain, backache, differential diagnosis of, 456
 dilatation and curettage and, 103
 cervical carcinoma and, 589
 ectopic pregnancy and, 693
 intermenstrual, 138
 menstrual, benign uterine tumors and, 498
 postoperative, sedatives for, 419
 seat of, determination of, 83
- Palpation, cystitis diagnosis and, 863
 examination of bladder and urethra by, 809
- Panhysterectomy, steps in, 606
- Panhysteromyomectomy, hysteromyomectomy and, 530
 technique of, 538
- Papillary adenocarcinomata, ovarian, 745
- Papillary carcinomata, fallopian, 790
- Papillary ovarian tumors, diagnosis of, 742, 745, 771
 history of, 738
 incidence of, 738, 740
 malignant potentialities of, 738
- Papillary parovarian cysts, 765
- Papillomata, cervical, electrotherapy and, 987
 fallopian, 789
 vesical, pathology of, 904
 results of treatment of, 919
- Parametrium, extension of cervical carcinoma to, 584
- Parasitic myomata, 512
- Pauöphorosalingohysterectomy, 434
- Parotitis, postoperative, 420
- Parovarian cysts, age incidence of, 761
 diagnosis of, 763, 772
 extra-uterine pregnancy and, 681
 origin of, 760
 sterility and, 164
 symptoms of, 763
- Parovarium, anatomy of, 17, 50, 760
- Pedicle, ligation of, 399
 rotation of, ovarian tumors complicated by, 773
- Pediculosis pubis, 188
- Pelvic floor, injury to, general considerations of, 298, 358
 invagination of, 70
 muscles of, 30
- Pelvic tuberculosis, radium in, 953
- Pelvis, abscess of, complications of, 626, 632
 diagnosis of, 628
 extension of, 626
 history of, 624
 pathology of, 625
 postoperative care of, 633
 protein therapy and, 928
 restrictions of the term, 625
 treatment of, 629
 symptomatology of, 627
- adult, anatomy of, 2, 64
 blood supply of, 13, 28
 chronic inflammatory disease of, x-ray treatment of, 963
 comparison of adult and infantile, 2
 coronal section of, anatomy of, 33
 diaphragm of, anatomy of, 290
 fascia and ligaments of floor of, anatomy of, 289, 358
 injuries to, 298, 358
 fasciæ of, 34
 four cardinal projections of abdomen and, 85
 infantile, anatomy of, 2
 infections of, protein therapy in, 926
 injuries to fascia and ligaments of, 298, 358
 invagination of floor of, 70
 lymphatics of, 20
 extension of cervical carcinoma to, 586
 muscles of, anatomy of, 24
 nerve supply of, 25
 outlet of, anatomy of, 289
 sagittal section of, anatomy of, 22
 sarcoma of, edema in, 191
 superior strait aspect of, anatomy of, 27
 tumors of, abdominal signs of, 90
 upper floor of, anatomy of, 294
 importance of, 296
 view from below, anatomical considerations, 28
 viscera of, anatomy of, 11
 appendix pathology and, 470
 bimanual examination of, 67
 determination of seat of pain in, 83
 Gartner's duct relation to, 382
 knee-chest examination of, 76, 82
 wolffian duct relation to, 382

- Percussion, examination of bladder and urethra by, 809
- Perflation of the tubes, 169
- Perforating hemorrhagic (chocolate) cysts, ovarian, 794
- Perineal body, anatomy of, 290
- Perineum, "center" of, 290
complete tear of, 269
external superficial tear of, 267
internal tear of, 267
lacerations of, complete tear of recto-vaginal septum, 269
external superficial tear, 267
internal tear, 267
old complete tear, 283
recent injuries classified, 267
relaxed vaginal outlet, 271
repair of, 303
supports of vaginal outlet, 265
normal measurement of, 271
old complete tear of, 283
recent injuries of, 267
- Peristalsis, fallopian tube, 176
- Peritoneum, adhesions of, extra-uterine pregnancy and, 681
length of incision and how to find, 394
- Peritonitis, gonorrheal salpingitis and, 646
reflux of intra-uterine injections causing, 105, 169
tuberculous encysted, ovarian cyst resembling, 770
tuberculous, protein therapy and, 927
radium in, 953
tuberculous salpingitis and, 661
- Peruterine tubal insufflation in sterility, apparatus for, 172
closed tube signs, 178
contra-indications, 171, 175
development of, 169
effect upon menstruation, 182
indications for, 170
interpretation of, 176
kymographic records of, 176, 181
most favorable time for, 171
normal tube signs in, 176
pregnancy following, 183
repetition of test, 182
spasm of tubes in, 179
summary of, 185
technique of, 173
therapeutic value of, 183
- Pessaries, glass ball, 490
stem, acute antelexion and, 163
dysmenorrhea and, 137
- Pessaries, Thomas-Smith, retrodisplacements and, 162
types of hard rubber, 489
upset, 492
- Pezzer catheter, incontinence and, 822
- Phlebitis, postoperative, 424
- Physioneurosis, 1008
- Physometra, cervical disease and, 264
- Pilimiction, 856
- Pinces à demeure, 452
- Placental polyp, uterine hemorrhage and, 149
- Pleurisy, postoperative, 421
- Pneumonia, amenorrhea and, 129
postoperative, 421
- Pneumoperitoneal roentgenography, contra-indications of, 966
general considerations of, 965
summary of, 970
technique of, 966
value of, 968
- Pneumophotography, 165, 174
- Polyps, cervical, 260
carcinoma resembling, 592
uterine hemorrhage and, 145
fallopian, 789
intra-uterine, hemorrhage and, 145
placental, uterine hemorrhage and, 149
tubal, ectopic pregnancy and, 677
urethral, electrotherapy and, 989
- Polyp forceps, 100, 102
- Postoperative care, 409
- Postoperative complications, 414
- Postpartum or postabortal infection, appendicitis differentiated from, 474
- Posture, backache and, 462
dorsal, examination in, 65
knee-chest, 76, 82
lithotomy, 65
Sims, examination in, 76
- Poupart's ligament, anatomy of, 5, 25
- Pregnancy, abdominal signs of, 91
cervical carcinoma aggravated by, 592
cervical injuries following, carcinoma and, 574
corpus luteum of, histology of, 59
early diagnosis of, pneumoperitoneal roentgenography and, 971
endometrium of, 48
extra-uterine, chorio-epithelioma of tube and, 709
classification of, 682
clinical history of, 688
criteria of, 686
Cullen's sign in, 696

- Pregnancy, extra-uterine, definition of, 673
 diagnosis of, 692
 etiology of, 674
 fetal abnormality and, 712
 hemorrhage from, 150
 mortality of, 720
 myomectomy complicated by, 560, 567
 prognosis of, 708
 repeated, 711
 symptoms of, 692
 treatment of, 712, 716
 x-ray diagnosis of, 698
 fibroid tumors of uterus mimicking, 518
 Hegar's sign of, 41
 interstitial, criteria of, 685
 treatment of, 719
 menstruation during, 129
 multiple, extra-uterine pregnancy and, 709
 myomectomy and, 522, 556, 560, 567
 ovarian, criteria of, 685
 peruterine tubal insufflation followed by, 183
 primary dysmenorrhea and, 137
 rudimentary uterine horn, 721
 ruptured ectopic, appendicitis differentiated from, 474
 tubal, chorio-epithelioma of tube and, 709
 classification of, 682
 clinical history of, 688
 criteria of, 686
 Cullen's sign of, 696
 definition of, 673
 diagnosis of, 692
 etiology of, 674
 fetal abnormality and, 712
 hemorrhage from, 150
 mortality of, 720
 myomectomy complicated by, 560, 567
 prognosis of, 708
 repeated, 711
 symptoms of, 692
 treatment of, 712, 716
 x-ray diagnosis of, 698
 vaginal reaction to, 41
 vaginitis of, 223
 Premature labor, syphilis and, 167
 Premature menopause, 124
 Preparation of patient, 392
 Primary dismenorrhea, etiology of, 132
 treatment of, 137
 Primordial follicles, histology of, 54
 Procidentia, complete, modified Mayo operation for, 334
 Prolapsed urethral mucosa, 820
 Prolapsus mucosæ urethralis, electrotherapy and, 989
 Prolapsus ovarii, suspension of, 486
 Prolapsus uteri, anatomical considerations of, 308
 cystocele and, 307
 cystocele repair by modified Watkins operation, 326
 Farrar operation for large cystocele associated with myomatous uterus, 351
 history of, 305
 injuries to muscle-fascia diaphragms of pelvis and, 298
 modified Mayo operation for, 334
 old age absorption of fat and, 297
 repair of, 303
 vaginal hysterectomy and, 444
 Protein therapy, adjuvants to, 926
 contra-indications to, 928
 initial dose, 925
 interval between injections, 925
 outward signs of, 924
 propitious time for administration of, 924
 site of injection, 925
 substances used in, 924
 technique of, 925
 theory of, 923
 Prothrombin, blood coagulation and, 142
 Pruritus vulvæ, diagnosis of, 228
 electrotherapy and, 985
 etiology of, 227
 treatment of, 229, 963, 985
 x-ray treatment of, 963
 Pseudohermaphroditism, Klebs classification of, 109
 Pseudomucin, 735
 Pseudomucinous cystomata, 734
 Pseudomyxoma peritonei, 736
 Psoas muscle, anatomy of, 24
 Psychasthenia, 1006
 Psychiatry and mental hygiene, general discussion of, 995
 Psychic dyspareunia, 235
 Puberty, menstruation and, 119
 Pubococcygeus muscle, anatomy of, 290
 Puborectalis muscle, anatomy of, 290
 Puerperal infection, pelvic abscess and, 625
 protein therapy in, 925
 sterility caused by, 159
 Pulse, postoperative, 413, 417

- Pyelitis, acute, appendicitis differentiated from, 474, 475
- Pyometra, cervical disease and, 264
protein therapy and, 927
- Pyosalpinx, benign uterine tumors and, 502
myomeetomy complicated by, 567
protein therapy in, 926
- Pyriformis muscle, anatomy of, 25
- Radium, amenorrhea and, 130
apparatus for use of, 936
sterilization of, 938
carcinoma of cervix and, 593
clinical applications of, 940
effect on tissues, 934
functional uterine bleeding and, 153
history of, 929
ovarian tumors and, 788
physiology of, 930
principles of dosage, 939
protection of personnel against, 938
sarcoma of uterus and, 613
tuberculosis of vulva and, 199
uterine hemorrhage and, 151
vesical tumors and, 914, 922
- Recovery, postoperative, 414
- Rectocele, fascial injury resulting in, 291
relaxed vaginal outlet and, 271
treatment of, 273, 277, 302, 359
- Rectopelvic vaginal fistula, pelvic abscess complicated by, 632
- Recto-uterine muscles, anatomy of, 295
- Rectovaginal septum, adenomyoma of, x-ray and, 963
complete tear of, 269
- Rectovesical fascia, anatomy of, 290
- Rectum, anatomy of, 11
atmospheric distention of, pelvic examination with aid of, 73
examination of, 78
extension of cervical carcinoma to, 583
hernia of, repair of, 302, 359
infantile, position of, 3
inspection of, 81
normal position and relation of, 64
palpation of, 80
pelvic examination by way of, 72
stricture of, 397
- Rectus abdominalis muscle, anatomy of, 5
- Relaxed vaginal outlet, demonstration of, 272
inspection of, 271
mensuration of, 273
palpation of, 273
- Relaxed vaginal outlet, percussion of, 278
synonyms for, 271
treatment of, 273
- Repeated extra-uterine pregnancies, 711
- Reproduction, threshold of, 166
- Resuscitation and transfusion, 401, 415
- Rete ovarii, 59
- Retinaeulum uteri, Martin's, 295
- Retractors, 395, 396
- Retroposed uterus, bimanual examination of, 73
dysmenorrhea caused by, 135
pessaries in treatment of, 488
sterility and, 160
suspension of uterus for, 480
treatment of, 162
- Rhabdomyomata, vesical, 909
- Rheumatic fever, acute, sterility and, 159
- Ring pessary, introduction of, 491
- Rodent ulcer, 199
- Rotation of pedicle, ovarian tumors complicated by, 773
- Round ligaments, histology of, 50
- Rudimentary tubes, myomeetomy complicated by, 567
- Rudimentary uterine horn, pregnancy in, 721
- Rupture, cystic, ovarian tumors complicated by, 776
- Ruptured corpus luteum, appendicitis differentiated from, 475
- Ruptured ectopic pregnancy, appendicitis differentiated from, 474
- Sacral anesthesia, administration of, 429
anatomical considerations of, 427
bibliography of, 427
selection and preparation of patient for, 428
solution and instruments for, 429
- Sacralization, fifth lumbar, backache and, 458
- Sacro-iliac belt, 459
- Sacro-iliac joint, tuberculosis of, backache and, 467
- Sacro-iliac luxations, backache and, 457
- Sacro-iliac strains backache and, 461
- Sacrum, anatomy of, sacral anesthesia and, 427
promontory of, relation to anterior abdominal wall, 10
- Sagittal bisection, abdominal hysterectomy by, 437
- Salivary gland, postoperative inflammation of, 420

- Salpingectomy, chronic gonorrheal salpingitis and, 655
- Salpingitis, acute gonococcal, appendicitis differentiated from, 472
- chronic, appendicitis differentiated from, 475
- myomectomy complicated by, 567
- electrotherapy and, 984
- gonorrheal, 642, 650
- acute stage of, 650
- chronic stage of, 651
- extra-uterine pregnancy and, 680
- pelvic abscess and, 625
- nodular, 670
- tuberculous, age incidence of, 664
- diagnosis of, 668
- examination for, 668
- history of, 660
- pathology of, 661
- pelvic abscess and, 625
- prognosis of, 671
- sterility and, 161
- symptomatology of, 666
- treatment of, 669
- x-ray treatment of, 964
- uterine hemorrhage and, 150
- Salpingo-oophorectomy, hysterosalpingo-oophorectomy preferable to, 432
- Sampson's endometriomata, 800
- Sarcoma deciduocellulare, etiology of, 614
- history of, 613
- treatment of, 616
- Sarcomata, cervical, 261
- fallopian, 792
- ovarian, age incidence of, 758
- characteristics of, 759
- connective-tissue origin of, 757
- gross appearance of, 758
- metastasis of, 759
- varieties of, 757
- pelvic, edema in, 191
- spinal, backache from, 468
- urethral, 828
- uterine, classification of, 608
- diagnosis of, 611
- hemorrhage and, 149
- history of, 607
- incidence of, 608
- prognosis of, 611
- symptomatology of, 611
- treatment of, 613
- x-ray treatment of, 962
- vaginal, 387
- vesical, pathology of, 907
- results of treatment of, 921, 922
- vulvar, 209
- Scarlatina, sterility and, 159
- Seat of pain, significance of, 83
- Secondary carcinomata, ovarian, 748
- Secondary dysmenorrhea, etiology of, 134
- treatment of, 137
- Secondary hemorrhage, control of, 416
- Secretions, internal, amenorrhea and, 152
- dysmenorrhea and, 154
- functional uterine bleeding, 153
- sterility and, 154
- vaginal, sterility and, 160
- Semilunar line, anatomy of, 5
- Senile vaginitis, uterine hemorrhage and, 151
- Septate uterus, pregnancy in, 702
- Septate uterus and vagina, cause of, 114
- Septate vagina, sterility and, 159
- Septum, rectovaginal, complete tear of, 269
- old complete tear of, 283
- Serous cystomata, simple, 727
- Sex, puberty and consciousness of, 119
- secondary characteristics of, inhibition of, 114
- Sex instinct, preadolescent development and management of, 998
- Shock, 414
- Simple serous cystomata, 727
- Sims posture, 75
- Skene's ducts, histology of, 38
- Skene's glands, concealed abscess of, 825
- gonorrheal infection of, 637
- infection of, electrotherapy of, 984
- inspection of, 812
- suburethral abscess of, treatment of, 239
- tuberculosis of, 664
- Skin, diseases of, diabetic vulvitis, 189
- furunculosis vulvæ, 188
- intertrigenous dermatitis, 188
- leukoderma, 189
- pediculosis pubis, 188
- vittiligo, 189
- Small intestine, anatomy of, 6
- length of, 9
- Smith pessary, 489, 491
- Solènome adenomyomata, 799
- Sounds, uterine, diagnosis by, 74
- Spasm, fallopian tube, gas insufflation causing, 179
- Specula, examination of children and young girls with, 78
- tubular, 79, 83
- rectal, use of, 80
- vaginal, use of, 66
- vesical, 812
- Sphincter ani muscle, anatomy of, 31

- Spina bifida occulta, backache differentiated from, 457
- Spinal anomalies, backache differentiated from, 457
- incomplete sacralization of first sacral vertebra, 459
- impinging spinous processes of lower lumbar vertebra, 459
- sacralization or fusion of fifth lumbar vertebra, 458
- spina bifida occulta, 457
- Spine, metastasis in, backache following, 468
- neurological conditions of, backache and, 469
- pathological conditions in, backache and, 464
- Spondylololthesis, backache and, 462
- Sponge-tests, use of, 99
- Stem-pessaries, acute antelexion and, 163
- dysmenorrhea and, 137
- Stenosis, cervical, sterility and, 160
- treatment of, 161
- Sterility, diet in treatment of, 166
- dyspareunia and, 236
- ectopic pregnancy and, 692
- endocrinology and, 154
- etiology of, 158
- gas insufflation in, 169
- grouping of factors responsible for, 160
- organotherapy and, 156
- peruterine tubal insufflation in, apparatus for, 172
- closed tube signs, 178
- contra-indications, 171, 175
- development of, 169
- effect upon menstruation, 182
- indications for, 170
- interpretation of, 176
- kymographic records of, 176, 181
- most favorable time for, 171
- normal tube signs, 176
- pregnancy following, 183
- repetition of the test, 182
- spasm of tubes from, 179
- summary of, 185
- technique of, 173
- therapeutic value of, 183
- value of, 165
- radium and, 953
- treatment of, 161
- x-ray production of, 961
- Stillbirth, syphilis and, 167
- Stone, bladder, 839
- ureteral, appendicitis differentiated from, 474, 475
- Strains, lumbosacral, backache and, 457, 460
- sacro-iliac, backache and, 461
- Stricture, ureteral, appendicitis differentiated from, 475
- bulbed catheters and, 894, 896
- cystoscopy and, 893
- definition of, 873
- descensus uteri and, 888
- diagnosis of, 882
- dysmenorrhea and, 884
- dyspareunia and, 888
- etiology of, 873
- incidence of, 876, 877
- menorrhagia and, 890
- morbid anatomy of, 877
- ovarian neuralgia and, 886
- symptoms of, 882
- treatment of, 897
- urinalysis in, 883
- urethral, 821
- Subepithelial hematoma, Gebhart's, 46
- Subinvolved uterus, abdominal hysterectomy and, 432
- Submucous fibromata, uterine hemorrhage from, 147
- Submucous myomata, carcinoma resembling, 592
- myomectomy and, 524
- Subphrenic pneumoperitoneum, 170, 174
- Suburethral abscess, 824
- treatment of, 239
- Sulcus tears, 358
- Superficial perineal fascia, anatomy of, 292
- Superficial perineal tear, external, 267
- Superior aponeurotic space, anatomy of, 292
- Supports of vaginal outlet, perineal lacerations and, 265
- Suppurating myomata, myomectomy complicated by, 549
- Suprapubic extraperitoneal cystostomy, vesical tumors and, 912
- Surgery, abdominal, general principles of, 389
- Surgical endothermy, vesical tumors and, 913
- Suspension, ovarian, prolapse and, 486
- uterine, retrodisplacement and, 480
- Sustentaculum, Bonney's, 294
- Sutures, removal of, 414
- Syncytioma malignum, etiology of, 614
- history of, 613
- treatment of, 616

- Syphilis, cervical, 255
 carcinoma resembling, 592
 sterility and, 167
 uterine hemorrhage and, 151
 vulvar, 191
 Wassermann reaction and, 96
 Syphiloma, 199
- Tears, perineal, complete tear of recto-vaginal septum, 269
 old complete, 283
 recent, 267
 sulcus, 358
- Temperature, postoperative, 413, 417
- Tension states, sex conflict and, 1008, 1010
- Teratomata, ovarian, 756
- Third sphincter, 72
- Thirst, postoperative, 411
- Thomas-Smith pessary, 489
- Threshold of reproduction, 166
- Thrombin, blood coagulation and, 142
- Thrush, pruritus vulvæ and, 229
- Thyroid, carcinoma of, backache following metastasis of, 468
- Tissue microscopy, 97
- Tonsils, uterine hemorrhage and, 143
- Torsion, globular myomatous uterus and, 541, 545
- Traction forceps, Fergusson, 100
- Transfusion, chlorosis and, 143
 resuscitation and, 401, 415
- Transperitoneal cystostomy, vesical tumors and, 913
- Transuterine tubal insufflation, 169
- Transversalis muscle, anatomy of, 5
- Transversus perinei muscles, anatomy of, 31, 289
- Triangular ligament, anatomy of, 291
- Trichomonas vaginalis, leukorrhea and, 222
- Trigone, urogenital, anatomy of, 291, 806, 819
- Trigonitis, ureteral stricture and, 890, 893
- Tubal abortion, appendicitis differentiated from, 474
 ectopic pregnancy and, 705
- Tubal chorio-epitheliomata, extra-uterine pregnancy and, 709
- Tubal hematocele, tuberculosis and, 707
- Tubal insufflation in sterility, peruterine, 169
- Tubal pregnancy, chorio-epithelioma of tube and, 709
- Tubal pregnancy, classification of, 682
 clinical history of, 688
 Cullen's sign in, 696
 definition of, 673
 diagnosis of, 692
 etiology of, 674
 fetal abnormality and, 712
 hemorrhage from, 150
 mortality of, 720
 myomectomy complicated by, 560, 567
 prognosis of, 708
 repeated, 711
 ruptured, appendicitis differentiated from, 474
 symptoms of, 692
 treatment of, 712, 716
 x-ray diagnosis of, 698
- Tuberculosis, amenorrhea and, 129
 cervical, carcinoma resembling, 592
 dysmenorrhea and, 132
 lumbosacro-iliac, backache and, 466, 467
 myomectomy complicated by, 567
 pelvic, radium in, 953
 tubal hematocele and, 707
 vulval, 197
 vulvovaginal, 214
- Tuberculous cervicitis, 256
- Tuberculous cystitis, palpation of bladder and, 810
- Tuberculous endometritis, myomectomy complicated by, 556
- Tuberculous endometritis, uterine hemorrhage and, 145
- Tuberculous oöphoritis, x-ray treatment of, 964
- Tuberculous peritonitis, encysted, ovarian cyst resembling, 770
 protein therapy and, 927
 radium in, 953
- Tuberculous salpingitis, age incidence of, 664
 diagnosis of, 668
 examination for, 668
 history of, 660
 pathology of, 661
 pelvic abscess and, 625
 prognosis of, 671
 sterility and, 161
 symptomatology of, 666
 treatment of, 669
 x-ray treatment of, 964
- Tubes, fallopian, anatomy of, 11
 appendicitis and diseases of, 471
 bimanual examination of, 71
 ectopic pregnancy and atresia of, 677

- Tubes, ectopic pregnancy due to accessory ostia of, 680
 extension of cervical carcinoma to, 581
 extra-uterine pregnancy and diverticula from lumen of, 679
 extra-uterine pregnancy and chorio-epithelioma of, 709
 extra-uterine pregnancy and inflammatory affections of, 680
 extra-uterine pregnancy and polyps of, 677
 extra-uterine pregnancy due to decid-ual reaction in, 675
 extra-uterine pregnancy due to per-sistence of fetal type of, 678
 gonorrheal infection of, 642, 650, 651
 hematoceles in, 707
 histology of, 51
 myomectomy complicated by disease of, 567
 myomectomy complicated by rudi-mentary, 567
 peristalsis in, 176
 peruterine insufflation to determine patency of, 169
 sterility and occlusion of, 160, 164
 tuberculous of, 661
 tumors of, 789
 x-ray treatment of disease of, 964
- Tubo-ovarian abscess, incision for, 396
- Tubo-ovarian cyst, myomectomy compli-cated by, 567
- Tumors, abdominal and pelvic, direction taken by growth of, 86
 mensuration of, 88
- benign uterine, adenomyoma, 168
 characteristics of, 496
 diagnosis of, 515
 form peculiarities of, 514
 incidence of, 498
 site of, 504
 symptomatology of, 498
 treatment of, 518
 x-ray treatment of, 521
- cervical, 260
- dysmenorrhea and, 135
- endometrial, etiology of, 794
 pathology of, 794
 symptomatology, 793
 treatment of, 801
- fibroid, malignancy of, 149
 uterine hemorrhage and, 148
- hymeneal, 221
- malignant uterine, adenomyoma, 618, 622
 carcinoma of body of uterus, 600
- Tumors, malignant uterine, carcinoma of cervix, 572
 chorio-epithelioma, 613
 sarcoma, 607
 x-ray treatment of, 962
- ovarian, adenocarcinoma, 743
 adhesions complicating, 779
 benign epithelial, 727
 carcinoma, 743
 classification of, 725
 complications of, 773, 786
 connective-tissue, 756
 cystic rupture of, 776
 dermoid cyst, 750, 772
 embryoma, 749
 endometrial hematoma of ovary, 793
 fibroma, 756
 hydatid of Morgagni, 766
 inflammatory cysts, 767
 intraligamentary cysts and, 781
 Krukenburg tumor, 748
 malignant epithelial, 743
 mixed types of, 749
 multilocular cystadenoma, 729
 new growths, 727
 operative treatment of, 778
 papillary, 738, 772
 papillary adenocarcinoma, 745
 papillary cystadenosarcoma, 746
 parovarian cyst, 760
 pseudomucinous cystoma, 734
 radium and, 788
 relative incidence of, 726
 rotation of pedicle of, 773
 sarcoma, 757
 secondary carcinoma, 748
 simple retention cysts, 727
 simple serous cystoma, 727
 teratoma, 756
 treatment of, 776
 x-ray treatment of, 788, 963
- pelvic, abdominal signs of, 90
- spinal cord, backache and, 469
- tubal, 789
- uterine fibroid, characteristics of, 496
 diagnosis of, 515
 form peculiarities of, 514
 incidence of, 498
 site of, 504
 symptomatology of, 498
 treatment of, 518
 x-ray treatment of, 521, 961, 962
- vaginal, adenomyoma, 385
 benign solid, 385
 carcinoma, 385
 colpitis emphysematosa, 384

- Tumors, vaginal, cysts, 380
 diagnosis of, 384
 echinococcic cyst, 384
 electrotherapy and, 985
 embryonic epithelial structure cyst, 382
 gas cysts, 384
 gland cyst, 382
 malignant, 385
 myoma, 385
 treatment of, 384
 vesical adenocarcinoma, 907
 adenoma, 906
 age incidence of, 903
 carcinoma, 906
 classification of, 901
 cysts, 906
 diagnosis of, 910
 etiology of, 903
 frequency of, 903
 history of, 901
 incidence of, 903
 myoma, 908
 papilloma, 904
 pathology of, 904
 radium and, 914, 922
 results of treatment of, 919, 922
 sarcoma, 907
 sex incidence of, 903
 symptoms of, 909
 treatment of, 912, 913, 922
 x-ray treatment of, 918, 922
 vulvar, benign, 202
 electrotherapy and, 985
 malignant, 206
 Tunica dartolabialis, 37
 Tupelo, use of, 99
 Tympanites, abdominal signs of, 89
 postoperative, 418
 Typhoid fever, amenorrhea and, 129
- Ulcerative cystitis, 860
 Ulcerative vulvitis, chronic hypertrophic, 191, 199
 Ulcers, cervical, carcinoma resembling, 592
 rodent, 199
 vesical, electrotherapy and, 992
 excision of, 872
 Ultraviolet radiation, tuberculosis of
 tubes and ovaries and, 964
 value of, 972
 Umbilicus, discoloration of, extra-uterine
 pregnancy and, 696
 Upper pelvic floor, anatomy of, 294
 importance of, 296
- Upset pessary, 492
 Ureteral folds, 806
 Ureteral injuries, 398
 Ureteral stone, appendicitis differentiated
 from, 474, 475
 Ureteral stricture, bulbed catheters and,
 894, 896, 898
 cystoscopy and, 891
 definition of, 873
 descensus uteri and, 888
 diagnosis of, 882
 dysmenorrhea and, 884
 dyspareunia and, 888
 etiology of, 873
 incidence of, 876, 877
 menorrhagia and, 890
 morbid anatomy of, 877
 ovarian neuralgia and, 886
 symptoms of, 882
 treatment of, 897
 urinalysis and, 883
 Ureters, anatomy of, 13
 pelvic relations of, 14
 myomectomy complicated by, 561
 Urethra, carcinoma of, 828
 caruncle of, 239, 827
 cyst of, 830
 diseases of, carcinoma, 828
 caruncle, 827
 chronic urethritis, 824
 cyst of, 830
 displacements, 820
 electrotherapy and, 989
 incontinence, 821
 ischuria, 823
 new growths, 826
 prolapsed mucosa, 820
 radium in, 940
 sarcoma, 828, 829
 stricture, 821
 suburethral abscess, 824
 displacements of, 820
 examination of, inspection, 811
 instruments for, 813
 palpation, 809
 percussion, 809
 urethroscopic, 811
 urinalysis, 809
 fibroma of, 829
 glands of, examination of, 811
 granuloma of, 239
 new growths of, 826
 polyps of, electrotherapy and, 989
 prolapsed mucosa of, 820
 sarcoma of, 828
 stricture of, 821

- Urethral dilators, 813
- Urethral diverticulum, 824
- Urethral urinary pocket, 824
- Urethritis, chronic, treatment of, 824
 - gonorrheal, electrotherapy and, 983
- Urethrocele, treatment of, 299
- Urinalysis, 93
 - cystitis diagnosis and, 862
 - examination of bladder and urethra by, 809
 - ureteral stricture and, 883
- Urinary tract, diseases of, electrotherapy and, 992
- Urogenital diaphragm, anatomy of, 291
- Urogenital trigone, anatomy of, 291
- Uterine hemorrhage, etiology of, 141
 - functional, endocrinology and, 153
 - organotherapy and, 156
 - index to, 141
- Uterine myomata, sterility and, 161
 - treatment of, 163
- Uterine sounds, diagnosis by, 74
- Uterine tubes, atresia of, extra-uterine pregnancy and, 677
 - decidual reaction in, ectopic pregnancy due to, 675
 - diseases of, appendicitis and, 471
 - myomectomy complicated by, 567
 - x-ray treatment of, 964
 - diverticula from lumen of, extra uterine pregnancy and, 679
 - ectopic pregnancy due to accessory ostia of, 680
 - ectopic pregnancy due to persistence of fetal type of, 678
 - extension of cervical carcinoma to, 581
 - extra-uterine pregnancy and chorio-epithelioma of, 709
 - gas insufflation to determine patency of, 169
 - gonorrheal infection of, 642, 650
 - acute stage of, 650
 - chronic stage of, 651
 - hematocoles in, significance of, 707
 - inflammatory affections of, extra-uterine pregnancy due to, 680
 - occlusion of, sterility and, 160
 - treatment of sterility caused by, 164
 - peristalsis in, 176
 - polyps of, extra-uterine pregnancy and, 677
 - rudimentary, myomectomy complicated by, 567
 - tuberculous salpingitis and, 661
 - tumors of, 789
- Uteropubic fascial plane, anatomy of, 295, 306, 309
- Uterosacral ligaments, anatomy of, 13, 295
 - histology of, 51
- Uterotubal perflation or persufflation, 169
- Uterus, adenomyoma of, characteristics of, 618
 - clinical picture of, 620
 - history of, 618
 - malignancy of, 622
 - treatment of, 622
- anatomy of, 11
- anomalies of, sterility and, 160
- arcuate arteries of, 17
- benign tumors of, adenomyoma, 618
 - characteristics of, 496
 - diagnosis of, 515
 - form peculiarities of, 514
 - incidence of, 498
 - site of, 504
 - symptomatology of, 498
 - treatment of, 518
 - x-ray treatment of, 521
- bicornuate, 114, 242
- bimanual examination of, 70, 71
- blood supply of, 14, 16
 - intrinsic, 17
- body of, carcinoma of, 600
 - extension of cervical carcinoma to, 581
- carcinoma of, abdominal hysterectomy and, 432
 - vaginal hysterectomy and, 444
- cervix of, carcinoma of, 572
 - gonorrhea of, 637
 - radium in diseases of, 942
 - x-ray treatment of cancer of, 962
- chorio-epithelioma of, 613
- deciduoma malignum of, 613
- dimensions of, 41
- displacements of, pessaries in treatment of, 488
- double, 113, 242
- extirpation of, abdominal, 432
 - Doyen's, 453
 - vaginal, 444
- fibroid tumors of, radium in, 948
 - x-ray treatment of, 961
- fundus of, gonorrheal infection of, 642
 - radium in diseases of, 944
 - tuberculous salpingitis and, 662
 - x-ray treatment of cancer of, 963
- globular myomatous, 541
- hemorrhage from, etiology of, 141
 - polyps causing, 145
 - treatment of, 151

- Uterus, histology of, 41
 infantile, dysmenorrhea and, 133, 154
 position of, 3
 intrinsic blood supply of, 17
 ligaments of, histology of, 50
 lymphatics of, 20
 malignant tumors of, adenomyoma,
 618, 622
 carcinoma of body of uterus, 600
 carcinoma of cervix, 572
 chorio-epithelioma of, 613
 sarcoma, 607
 myoma of, abdominal hysterectomy
 and, 432
 extra-uterine pregnancy and, 681
 Farrar operation for large cystocele
 associated with, 351
 normal position and relations of, 64,
 308
 obstruction of canal of, dysmenorrhea
 caused by, 132
 prolapse of, anatomical considerations
 of, 308
 cystocele and, 307
 cystocele repair by modified Watkins
 operation, 326
 Farrar operation for large cystocele
 associated with myomatous
 uterus, 351
 history of, 305
 injuries to muscle-fascia diaphragms
 of pelvis and, 298
 modified Mayo operation for, 334
 old age absorption of fat and, 297
 repair of, 303
 ureteral stricture and, 388
 vaginal hysterectomy and, 444
 pulled-down, bimanual examination
 with, 74
 rectal examination of anterior surface
 of, 74
 retroposed, bimanual examination of,
 73
 treatment of, 162
 rudimentary horn of, pregnancy in, 721
 sarcoma of, x-ray treatment of, 962
 sarcoma deciduocellulare of, 613
 septate, 114
 pregnancy in, 702
 sounds used in examination of, 74
 subinvolution of, abdominal hysterec-
 tomy and, 432
 suspension of, retrodisplacement and,
 480
 syncytioma malignum of, 613
 tumors of, x-ray treatment of, 962
- Uterus didelphys, 242
 Uterus rudimentarius or fetalis, dysmen-
 orrhea and, 133, 154
 Uterus subpubescens, dysmenorrhea and,
 133, 154
 Uterus unicornis unicollis, 107
 Utriculoplasty, hysteromyomectomy and,
 530
 technique of, 533
- Vaccines, autogenous, vulvar furunculo-
 sis and, 189
- Vagina, absence of, 108, 129
 adenomyoma of, 385
 anomalies of, sterility and, 160
 treatment of, 161
 atresia of, 114
 sterility and, 159
 benign solid tumors of, 385
 bimanual examination of, 68
 blood supply of, 14
 carcinoma of, 385
 x-ray treatment of, 962
 chorio-epithelioma of, 388
 cysts of, colpitis emphysematosa, 384
 diagnosis of, 384
 echinococcic, 384
 embryonic epithelial structure, 382
 epithelial inclusion, 380
 gas, 384
 gland, 382
 treatment of, 384
 digital examination of, 66
 diseases of, gonorrhea, 637
 radium in, 941
 tuberculosis, 664
 displacements of, pessaries in treat-
 ment of, 488
 double, 112, 242
 extension of cervical carcinoma to, 582
 glands of, 40
 histology of, 38
 infantile, position of, 3
 inspection of outlet of, 65
 knee-chest position distending, 82
 lymphatics of, 20
 malignant tumors of, 385
 muscles of, 31
 myoma of, 385
 neoplasms of, 380
 electrotherapy and, 985
 treatment of, 384
 normal relations of, 310
 Pawlik's folds in, 806
 sarcoma of, 387

- Vaccines, secretions of, sterility and, 160
 septate, 114
 sterility and, 159
 trichomonas of, 222
 tumors of, adenomyoma, 385
 benign solid, 385
 carcinoma, 385
 colpitis emphysematosa, 384
 cysts, 380
 diagnosis of, 384
 echinococcic cyst, 384
 electrotherapy and, 985
 embryonic epithelial stricture cyst, 382
 gas cysts, 384
 gland cyst, 382
 malignant, 385
 myoma, 385
 treatment of, 384
- Vaginal atresia, 114
- Vaginal gland cysts, 382
- Vaginal hysterectomy, Doyen's, 453
 Hunner's, 453
 indications for, 444
 technique of, 445
- Vaginal outlet, old complete tear of, 283,
 recent injuries of, 267
 relaxed, demonstration of, 272
 inspection of, 271
 mensuration of, 273
 palpation of, 273
 percussion of, 278
 synonyms for, 271
 treatment of, 273
 supports of, perineal lacerations and, 265
- Vaginal specula, use of, 66
- Vaginismus, estimation of, 66
- Vaginitis, diphtheritic, 223
 emphysematous, 225
 exfoliative, 223
 gonorrheal, leukorrhea in, 222
 puerperal, 223
 senile, hemorrhage and, 151
- Varicose veins, vulvar, 190
- Venereal affections, vulvar, 191
- Venereal warts, 193
 cervical, 254
 electrotherapy and, 985
 gonorrheal infection and, 641
- Vermiform appendix, differentiation between gynecological conditions and acute appendicitis, 472
 differentiation between gynecological conditions and chronic appendicitis, 475
- Vermiform appendix, diseases of, pelvic organs and, 470
 pregnancy and, 478
 treatment of, 476
 positions of, 11
- Verruca acuminata, electrotherapy and, 985
- Viscera, abdominal, examination of, 84
 pelvic, anatomy of, 11
 appendix pathology and, 470
 bimanual examination of, 67
 determination of seat of pain in, 83
 Gartner's duct relations to, 382
 knee-chest examination of, 76, 82
 wolffian duct relation to, 382
- Visceral layer of endopelvic fascia, anatomy of, 290
- Vesical fistulas, diagnosis of, 845
 etiology of, 843
 symptomatology of, 844
 treatment of, general principles of, 845
 operative, 850
- Vesical injuries, 398
- Vesical tumors, adenocarcinoma, 907
 adenoma, 906
 eareinoma, 906
 cysts, 906
 diagnosis of, 910
 myoma, 908
 papilloma, 904
 sarcoma, 907
 symptoms of, 909
 treatment of, endothermy in, 913
 radium in, 914, 922
 results of, 919, 922
 surgical, 912
 x-ray in, 918, 922
- Vesico-uterine fistulas, operative treatment of, 854
- Vesico-utero vaginal fistulas, operative treatment of, 854
- Vesicovaginal fistulas, operative treatment of, 850
- Vesicular cystitis, 861
- Visitors, 394, 410
- Vitiligo, 189
- Vomiting, postoperative, 411, 417
- Vulva, abscess of glands of, 211
 adenomyoma of, 203
 angioma of, 191
 anomalies of, treatment of, 161
 benign tumors of, 202
 carcinoma of, 206
 x-ray treatment of, 962
 carcinoma of glands of, 214
 chaneroid of, 193

- Vulva, circulatory conditions of, 190
 common ailments of, 65
 condylomata acuminata of, 193
 cysts of glands of, 209
 edema of, 191
 diseases of, abscess of vulvovaginal glands, 211
 angioma, 191
 benign tumors, 202
 carcinoma of vulvovaginal glands, 214
 chancroid, 193
 chronic hypertrophic ulcerative vulvitis, 199
 circulatory conditions, 190
 clitoris and, 216
 condylomata acuminata, 193
 cysts of vulvovaginal glands, 209
 diabetic vulvitis, 189
 edema, 191
 furunculosis, 188
 gonorrhoea, 637
 gonorrheal vulvovaginitis, 191
 granuloma inguinale, 194
 hydrocele muliebris, 203
 hymen and, 218
 inguinal hernia, 204
 injuries, 189
 intertrigenous dermatitis, 188
 labia minora and, 215
 leukoderma, 189
 malignant tumors, 206
 pediculosis, 188
 primary tuberculosis of vulvovaginal glands, 214
 pruritus of, 227, 963
 radium in, 947
 skin lesions, 188
 syphilis, 191
 tuberculosis, 197
 varicose veins, 190
 venereal affections, 191
 vitiligo, 189
 fibroma and fibromyoma of, 203
 granuloma inguinale of, 194
 hematoma of, 189
 hydrocele muliebris and, 203
 injuries of, 189
 inspection of, 65
 lipoma of, 202
 malignant tumors of, 206
 sarcoma of, 209
 syphilis of, 191
 tuberculosis of glands of, 214
 tumors of, benign, 202
 malignant, 206
- Vulva, varicose veins of, 190
 venereal affections of, 191
 Vulvar furunculosis, 188
 Vulvitis, chronic hypertrophic ulcerative, 199
 edema in, 191
 diabetic, 189
 tuberculous, 197
 Vulvovaginal glands, abscess of, 211
 carcinoma of, 214
 cysts of, 209
 Vulvovaginal glands, tuberculosis of, 214, 664
 Vulvovaginitis, gonorrheal, electrotherapy and, 984
- Warts, venereal, cervical, 254
 Wassermann blood test, value of, 96
 Watkins operation, modified, cystocele repair by, 326
 Wertheim technique, carcinoma of uterus and, 594, 606
 White line, anatomy of, 5, 33
 Wolffian ducts, cyst of, 382
 parovarium and, 50
 relation to pelvic viscera, 382
- X-ray, application of, 960
 benign tumors of uterus and, 521
 diagnosis by, 960
 dosage of, 958
 ectopic pregnancy and, 697
 equipment for, 958
 functional uterine bleeding and, 153
 history of, 955
 ovarian tumors and, 788
 * sarcoma of uterus and, 613
 treatment by, 960
 adenomyoma and, 963
 carcinoma of vagina, 962
 cervical carcinoma, 962
 dysmenorrhea, 961
 fundus uteri, 963
 menorrhagia, 960
 ovarian tumors, 963
 pruritus vulvæ, 963
 sterilization in, 961
 stimulating dosage in, 961
 uterine fibroid, 961
 uterine hemorrhage, 151
 vesical tumors, 918, 922
 vulvar carcinoma, 962
- Young girls and children, gynecological examination of, 77